SOCIAL CAPITAL AND THE DIFFUSION OF ENERGY-REDUCING INNOVATIONS IN UK HOUSEHOLDS

by

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DECLARATION

I, Megan Hope McMichael, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signed:

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ABSTRACT

Research is presented on the influence of context-specific social capital in the diffusion of energy-reducing innovations within UK communities. This is motivated by the UK government's policy priority areas of climate change and energy use in the domestic sector. There is currently little evidence that standard technology and behavioural innovations will be adopted widely enough by householders in time to achieve Government energy efficiency targets. Accelerating rates of adoption are therefore important. Diffusion of innovation theory states that the communication of information on innovations through a social system encourages adoption. Social capital theory states that interpersonal communication is a key means of gaining resources, such as energy efficiency information, for attaining certain goals. There are no known previous empirical studies specifically examining the influence of social capital on information diffusion regarding the adoption of household energy efficiency measures in the UK. Using a multi-case case study research design and mixed methods approach, three British communities were surveyed, the quantitative findings of which were contextualised by qualitative focus group findings. The results show that social capital was used most often with newer innovations that were being promoted by an energy company through weakly-tied social network members. Respondents generally did not indicate seeking more information from people in the community than outside of it, but did indicate trusting information from local energy efficiency intermediaries. The findings show that while standard campaigns may account for two-thirds of information-seeking behaviour, they may not be addressing up to one-third of information-seekers who would prefer to speak to people they know. Findings also show that there are important differences to recognise between types of innovations and communities, and that tailoring campaigns to communities' communication channels is imperative. These findings have important implications for informing future community-based energy efficiency programmes.

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LIST OF ACRONYMS

Acronym	Full term
ACAT	Alyth Climate Action Town
AEG	Alyth Environment Group
AHL	Appliances, heating and lighting
BIS	Business, Innovation & Skills Department (UK)
CERT	Carbon Emission Reduction Target
CESP	Community Energy Saving Programme
CFL	Compact fluorescent light
CMP 5	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	Carbon dioxide
COP	Conference of Parties
DCLG	Department of Communities and Local Government (UK)
DECC	Department of Energy and Climate Change (UK)
Defra	Department for Environment, Food and Rural Affairs (UK)
DETR	Department of Environment, Transport and the Regions (UK)
EDRP	Energy Demand Research Project
EEC	Energy Efficiency Commitment
EERG	Energy Efficiency Resource Generator
EESoP	Energy Efficiency Standards of Performance
ESC	Energy social capital
EST	Energy Saving Trust
HWC	Hot water cylinder
IPCC	Intergovernmental Panel on Climate Change
IRT	Item-response theory
kWh	Kilowatt hour
MtC	Million tonnes of carbon
$MtCO_2$	Million tonnes of carbon dioxide
$MtCO_2e$	Million tonnes of carbon dioxide equivalent
MtOe	Million tonnes of oil equivalent
MW	Megawatt
Ofgem	Office of Gas and Electricity Markets
ONS	Office of National Statistics (UK)
OPEC	Organisation of Petroleum Exporting Countries
ppm	Parts per million
PTEM	Physical–technical–economic model
RAF	Royal Air Force
RG-UK	Resource Generator - United Kingdom
SCARF	Save Cash and Reduce Fuel
SCOT	Social construction of technology
SEWEA	South East Wales Energy Agency
SWALEC	South Wales Electricity
SSE	Scottish and Southern Energy plc
SSND	Survey of the Social Networks of the Dutch
TDM	Total Design Method
TVEC	Thames Valley Energy Centre
TWh	Terawatt hour
UCL	University College London
UK	United Kingdom
USA	United States of America
WWDF	Walls, windows, doors and floors

Chapter 1: INTRODUCTION

Current national energy policy in the UK places a large emphasis on tackling the long-term challenges of maintaining a secure supply of energy and reducing the country's impact on global climate change (Department of Energy and Climate Change (DECC) 2009b). A key priority area in achieving these goals, as indicated in the Government's most recent Energy White Paper (DECC 2009b), is reduction of energy use and increase in energy efficiency. For the domestic sector, this means encouraging energy efficient design and construction of new buildings and an increase in efficiency in existing dwellings. Existing buildings present particular challenges. One reason is that the building fabric of existing homes is often poorly designed or constructed; it was estimated that in 2003 the UK's existing 25 million homes made "up one of the oldest and least efficient housing stocks in Europe" (Boardman et al. 2005, p.38). Household buildings in the UK used approximately 28.5% of supplied energy in 2009 (DECC 2010a). Of that, it is estimated that up to one-third is lost due to inefficient use of energy (Parliamentary Office of Science and Technology 2005). It has been posited that householders often lack information or motivation to reduce household energy consumption (Department for Environment, Food and Rural Affairs (Defra) 2007a), in addition to facing deterrents such as financial costs.

As the energy sector is deregulated in the UK, the national government can only indirectly address energy efficiency by setting targets, implementing building regulations, and putting legal obligations on domestic energy suppliers to provide clear information and opportunities for energy reduction. The methods for household energy reduction that the UK government specifically encourages include technologies such as insulation (wall and loft), low energy lighting, highly efficient appliances and heating systems, and draught-proofing (Defra 2007a). The Department for Environment, Food and Rural Affairs " … estimate[s] that there is potential to reduce emissions from households by around a quarter, using established technologies available today" (Defra 2007a, p. 18).

Energy efficient technologies exist to reduce household consumption, but evidence points to slow diffusion (Jaffe & Stavins 1994). The diffusion of innovations, or "the process by which an innovation is communicated through certain channels over time among members of a social system" (Rogers 2003, p.5), assumes that there is a process by which certain innovations are accepted or rejected by groups of people. This process involves four elements: 1) the innovation, 2) communication, 3) time and 4) a social system. In the case of energy efficiency, the innovations are not only

technical (including insulation, low energy lighting, etc.), but also behavioural. Some technical innovations directly prevent the loss of energy, such as cavity wall insulation and low energy lighting. However, for most technical innovations, an element of behavioural innovation is needed as well. For example, efficient heating systems and appliances may use less energy than predecessors, but energy reduction is reliant on people operating the systems and appliances in a particular way. Another element of the diffusion of innovations – communication – occurs through social, interpersonal networks or through non-social means such as advertising. The rate of adoption takes place over time and is often measured by the percentage of people in a system that take up the innovation. The final element in the diffusion of innovations is the social system, which "… constitutes a boundary within which an innovation diffuses" (Rogers 2003, p.24), such as a community, region, or an entire nation.

Various institutions, including governmental and non-governmental organisations, are trying to encourage technical and behavioural energy efficiency innovations through policy and direct engagement with communities and constituents. However, efforts have largely focused on the technical aspects of domestic energy use, often overlooking the 'social' aspects (Lutzenhiser 1993; Shove 1997; Lutzenhiser et al. 2009). This is not to say that people or 'users' are not the focus of energy efficiency diffusion, but rather that an economically and technically-focused paradigm has dominated, assuming householders will be 'rational actors' and accept energy efficiency innovations because they are economically and environmentally superior to existing or prior technology (Guy 2006; Jackson 2005; Keirstead 2006). However, though people are expected to want to reduce energy use to save money, there is evidence that comfort and convenience are sometimes more important considerations to householders than financial savings (HM Treasury et al. 2005; Wilhite et al. 2000). The socio-technical approach aims to avoid technological determinism, an individualist approach to household energy efficiency, "and, critically, refuses to distinguish prematurely between technical, social, economic, and political aspects of energy use" (Guy 2006, p.650). If technology is considered more integrated with the social aspects of the population using them, a framework emerges that allows for several other considerations in the diffusion of domestic energy reducing innovations.

One social aspect that is rarely studied in the diffusion of energy reducing technical or behavioural innovations is the influence of interpersonal communication channels (Darley 1978; Weenig & Midden 1991; Rambo & Feldman 2003). In particular, social capital, which is defined here as "access to and use of social resources embedded in social networks" (Lin 1999, p.30), has not previously been considered with regard to

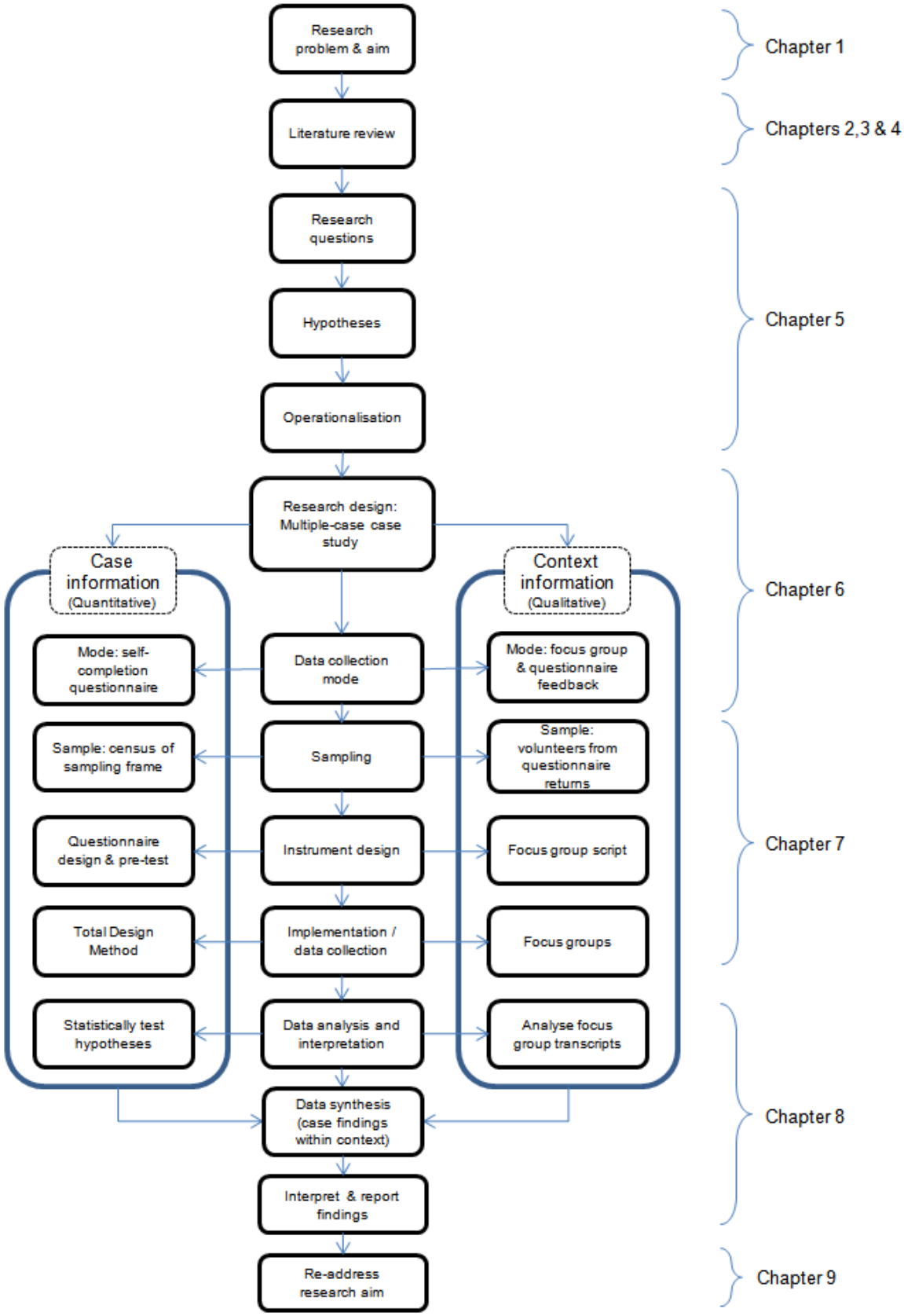
energy reduction. Social capital, popularised particularly in the 1980s and 1990s, includes elements of social network theory, but broadens the definition to allow for the consequences of embedded social resources, namely information diffusion, influence of agents, assured social credentials and reinforcement of identity and recognition (Lin 2001b). Social networks are comprised of loosely- or formally-defined groups of people who know each other in some way, e.g. friends or co-workers. Social resources refer to the resources available through social networks which "influence the success of achieving a given outcome or goal" (Johnson 2004 [online]). Social capital offers a new perspective which can be applied to the diffusion of energy-reducing innovations, emphasising the "positive consequences of sociability," while "call[ing] attention to how such nonmonetary forms can be important sources of power and influence" (Portes 1998, p.2).

In summary, if household energy-reducing innovations – whether technical innovations or behavioural changes – were adopted more quickly by more people, it is possible that household energy consumption would decrease at a faster rate than previously recorded (Vanderburgh et al. 2010). According to the diffusion of innovation theory, messages on innovations are spread through various forms of communication, including interpersonal communication. Accessing and mobilising social capital by seeking information resources within social networks is a way to gain more information, which facilitates the innovation-decision process and may ultimately lead to faster adoption of energy-reducing innovations. However, little is known about the impact of social capital on the diffusion of these innovations. This presents a large gap in the knowledge required for understanding the diffusion of innovations. The research problem is that the association between a context-specific social capital,[1] here referred to as 'energy social capital,' and the diffusion and ultimate adoption of household energy-reducing innovations is uncertain. The associated aim of this research, and the original contribution to knowledge, is to understand the influence of 'energy social capital' on the diffusion of energy-reducing innovations within UK communities.

In order to address the research problem and investigate the aim of the research, this thesis is structured in a manner to clearly outline the background, design, methods, results and conclusions, according to Figure 1-1.

[1] Context-specific social capital means the access and mobilisation of social resources for the purpose of gaining information on energy efficiency. This is in contrast to 'general' social capital which includes the resources available for broader, everyday life situations (van der Gaag & Snijders 2004b).

Figure 1-1: Thesis structure



Chapters 2, 3 and 4 consist of a literature review, putting the research aim into context. Chapter 2 addresses household energy consumption, which is largely a policy-driven issue in the UK. The current and historic state of household energy consumption and energy efficiency and conservation is reviewed, as are the contributions from social science on this subject. It is concluded that a socio-technical approach is appropriate for examining the diffusion of energy-reducing innovations. Chapter 3 defines and describes the diffusion of innovations, with particular focus on the innovation-decision process, and the status of diffusion of energy-reducing innovations. Chapter 4 reviews the literature and various definitions of social capital. Social capital is a contested concept, largely due to the various definitions and methods of measurements. There are two overarching 'branches' of the theory, one of which (the 'individual social capital' branch) presents a clear definition and methods of measurement, and is therefore followed in the research presented here. Chapter 5 offers a model of integrating the literature presented in Chapters 2, 3 and 4 and presents three research questions and the associated hypotheses. Chapter 5 also describes the operationalisation of the combined concepts according to each hypothesis. Chapter 6 explains the structure of the research, which firstly explains the populations which were investigated. These populations emerged from a real-world energy efficiency intervention conducted by a UK energy company. Three communities – one in England, one in Wales and one in Scotland – were encouraged to reduce their energy consumption by 10% over two years, after which point the communities would receive a monetary prize. This opportunity for investigation presented the prospect for a research design that includes three case studies. It was decided that a mixed methods research strategy was appropriate, using quantitative data resulting from self-completion questionnaires to study each population, enhanced by the results from qualitative focus groups. Chapter 7 describes the methods with which these communities were studied, outlining the quantitative sampling method, the questionnaire design, content and implementation. It also indicates the qualitative sampling method, focus group design and implementation. Further, this chapter reviews issues of concern, such as the validity and reliability, of the research implementation, and the ethics involved when dealing with human subjects. Chapter 8 integrates and critically discusses the quantitative results of the questionnaire, which are structured according to each hypothesis, in parallel with the findings of the qualitative research, and makes suggestions for further research. Finally, Chapter 9 offers conclusions of the research programme; it addresses the research problem and aim and the research questions and hypotheses, and makes suggestions for future energy efficiency interventions.

Chapter 2: HOUSEHOLD ENERGY USE IN THE UK

2.1 Introduction

Household energy use has received increasing attention in policy and academia in the past forty years. The global oil crisis in the 1970s had a worldwide impact on energy supply and prices and instigated a wave of energy research and policies in many countries (James 1986; Shove 1998; Aune 2007). The risks associated with global climate change due to human activities, and particularly energy production (IEA 2009), came to the foreground of policy in the 1980s (WCED 1987) and 1990s, culminating with an international agreement on greenhouse gas emissions in Kyoto in 1997 (UNFCCC 1998) and an ongoing international effort to curb further increases (IPCC 2007a). In accordance with the Kyoto Protocol, the UK Government has pledged to reduce its emissions by 12.5% between 2008 and 2012 compared to 1990 levels, a target which entered UK policy initially through the Climate Change Act (DETR 2000) and has been addressed in several subsequent energy and climate change policy documents. The UK Government has thus made the reduction of greenhouse gas emissions a priority in energy policy, along with the other key concerns of national energy security and the abolition of fuel poverty (DECC 2009b).

Energy conservation and energy efficiency have been asserted to be the fastest, most cost-effective initiatives which could make significant contributions to the needed CO_2 reductions (Defra 2007a). Despite successes in meeting interim energy efficiency goals through policy and supplier obligations (Ofgem & EST 2003; Ofgem 2005; Ofgem 2008), a variety of efforts will be necessary to meet the target of 29% reduction in emissions by 2020; reductions in household energy use are not forecast to meet expectations in 'business as usual' models (Chambers 2008). Current energy consumption constitutes 28.5% of total end use consumption (DECC 2010a). The UK Government has indicated that existing technologies could reduce energy consumption by 25% (Defra 2007a), however social scientists posit that lack of adoption of these technologies is perhaps due to the "blind spots" in policy with regard to human behaviour (Stern 1986), and encourage a greater role for behavioural research alongside economic and engineering research in the creation of energy policy (Dietz et al. 2009; Vanderburgh et al. 2010).

In order to address social and behavioural elements of energy research, this chapter reviews the literature on household energy use in the UK. As energy reductions in the household sector are largely motivated by policy, this chapter begins by discussing the

driving factors behind UK domestic-level energy policy. The section continues by highlighting pertinent national policies. This is followed by a summary of energy consumption and greenhouse gas trends in the UK domestic (non-transport) sector. The final section examines the policy assumptions which have been made and reviews alternative research approaches for encouraging reductions in household energy use. The chapter concludes by suggesting that one of these approaches, the diffusion of innovations, can contribute to the research agenda, particularly regarding the communication of energy efficiency information with the aim to ultimately encourage reductions in household energy consumption.

2.2 UK household energy policy drivers

Energy policies and regulations are key initiatives compelling current efforts in the reduction of household energy consumption. Energy policy also works hand-in-hand with climate change policy (Lovell et al. 2009), as reductions in energy consumption are associated with reductions in greenhouse gas emissions. The policies and regulations driving current efforts are the response to several problems related to energy production and consumption, namely energy security, carbon dioxide and other greenhouse gas emissions which contribute to climate change, and fuel poverty.[2]

2.2.1 Energy security

Energy security is "an uninterruptible supply of energy, in terms of quantities required to meet demand at affordable prices" (World Energy Council 2008, p 4). Vulnerabilities and risks to energy security can result from interruption or diminishment of feedstocks or complexity of the energy system (O'Keefe et al. 2010). Prior to the OPEC oil embargo in 1973, energy policy received little attention on issues that were not merely short-term problems (Surrey & Walker 1975). Subsequently, however, long-term energy security became a large priority for many countries, including the UK. In order to address the issues particularly related to oil shortages, the UK established a new Department of Energy in January 1974[3] and focused on alternatives to oil such as nuclear and renewable energy (James 1986) and coal (Skea 1981). The focus of energy security has changed in the past 40 years, as have the government departments which deal with energy,[4] with current concerns more focused on the

[2] Another driver is the changing stock of power stations (Greenhalgh & Azapagic 2009), though this is considered here to broadly fall under the category of energy security.
[3] Previous to the establishment of the Department of Energy, energy-related matters were handled under the Ministry of Fuel and Power from 1942 until 1957 when it was renamed the Ministry of Power. The Ministry of Power became part of the Ministry of Technology in 1969, which was then subsumed within Department of Trade and Industry in 1970 (Business, Innovations & Skills (BIS) 2010).
[4] The Government department which currently deals most directly with energy policy is the Department of Energy and Climate Change. However, certain issues pertaining to trade & skills are dealt with in the Business, Innovation and Skills and others, such as community energy, under the Department of

source of energy supplies, the ageing energy supply infrastructure, the potential changes in the global economy and geopolitics involved, and energy fuel availability (DTI 2007; Jamasb & Politt 2008; Cabinet Office 2008). Prior to the exploitation of gas from the North Sea, which began in 1967, the majority of UK's energy was derived from indigenous coal (DECC 2010k). This has since declined, and in 2009, coal (both indigenous, but mostly imported) contributed to approximately 14% of the share of energy supply (DECC 2010k), with approximately 60% coming from indigenous supplies of oil and gas (DECC 2010k). UK oil and gas production is now in decline, and there has been an increasing reliance on international supply (DECC 2010k).

The Government's Special Adviser on International Energy recently indicated that "there is no crisis" (Wicks 2009, p.1) with regard to energy security, however the UK Government is taking measures to ensure risks are kept to a minimum. In addition to increasing nuclear and renewable energy supply and addressing energy generating capacity and energy supply infrastructure, the UK Government has indicated that energy efficiency is an important element for maintaining energy security (DECC 2010e). Using resources as efficiently as possible in the domestic and other sectors can help decrease the amount of end-use energy, thereby decreasing the amount of supply necessary to satisfy demand. A reduction in the amount of energy supplied may lead to the need for fewer power stations, less internationally-sourced fuel, and better management of supplied energy capacity, all contributing to greater energy security.

2.2.2 Global climate change

Global climate change is widely recognised as the result of the anthropogenically-enhanced greenhouse effect. The greenhouse effect is the term given to the process which helps to regulate the temperature and climate that supports life on Earth.[5] The greenhouse effect is a natural process which enables life as we know it, but the activities of humans, particularly resulting from the energy industry, are believed to be the reason for the increasing excess of greenhouse gases. An IPCC (2007b) report states that the range of carbon dioxide in the atmosphere was between 180-300 parts per million (ppm) in the last 650,000 years. In 2005, however, there were 379ppm of CO_2 in the atmosphere, and ongoing trends indicate that this concentration is steadily increasing (Goldemberg & Lucon 2010). International policies are trying to prevent CO_2 from exceeding a 2 degree Celsius rise in temperature, which is estimated to be

Communities and Local Government, as well as environmental issues in the Department of Food and Rural Affairs. And ultimately, Her Majesty's Treasury has to approve all policies which require financial input from the Government.

[5] The sun's rays are absorbed as heat and light. Some of this thermal radiation is reflected back into the atmosphere, and some of that is trapped in a 'blanket' of gases which acts just as a greenhouse does for plants, keeping the Earth warm and enabling life as we know it (Goldemberg & Lucon 2010).

achievable if CO_2 concentrations are stabilised at approximately 400ppm; after this point, it is believed the consequences will be 'dangerous' for humans and other biological life forms (Tirpak et al. 2005). There are six major greenhouse gases,[6] and carbon dioxide receives more attention than any other (Goldemberg & Lucon 2010); carbon dioxide has the least impact of the six gases, but is created in the greatest abundance. The energy sector is responsible for "about 80% of anthropogenic greenhouse-gas emissions for the Annex I countries and about 60% of global emissions" (IEA 2009, p.8). In the UK, energy production and consumption was responsible for approximately 95% of CO_2 emissions and 85% of all the greenhouse gases in 2004 (DTI 2006).

Internationally, the UK is a signatory to the Kyoto Protocol of the United National Framework for Convention on Climate Change. Under this Protocol, the UK is committed to achieving targets of reducing greenhouse gas emissions by 12.5% on 1990 levels between 2008 and 2012 (DETR 2000). The UK has also participated in Conference of Parties (COP), which is the 'supreme party' of the convention, including the Fifth session of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP 5)[7] in December 2009 which addressed post-Kyoto greenhouse gas reduction targets. Nationally, the UK is committed to reducing carbon dioxide emissions by 80% on 1990 levels by 2050 (DECC 2009b).[8] Due to the predominance of emissions in the energy sector, policymakers now indicate that traditional energy systems need to adapt to become 'low carbon'[9] systems (DECC 2009b). Whilst energy generators are being encouraged to become more energy efficient on the supply side (Ofgem 2009b), reduction in energy consumption on the demand side is expected to play a critical part in the overall decline of CO_2 emissions, which would work along with other measures such as increases in renewable energy sources (DTI 2007; Kelly 2006).

2.2.3 Fuel poverty

Fuel poverty refers to the situation in which individuals pay above an acceptable amount on energy bills as compared to income. The UK definition is a household:

[6] The six major greenhouse gases are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), chlorofluorocarbon-12 (CCI_2F_2), hydrochlorofluorocarbon-22 ($CHCIF_2$), perfluoromethane (CF_4), and sulphur hexafluorine (SF_6) (Goldemberg & Lucon 2010).
[7] The CMP 5 was run in parallel with the COP-15 in December 2009 in Copenhagen (http://unfccc.int/meetings/cop_15/items/5257.php).
[8] This target was originally set at 60% in the 2003 Energy White Paper (DTI 2003), having accepted the Royal Commission for Environmental Pollution's recommendations on emission reductions (RCEP 2000). The target was revised in 2008 (*Climate Change Act* 2008).
[9] 'Low carbon' refers to lower carbon dioxide emissions.

> "which needs to spend more than 10% of its income on all fuel use and to heat its home to an adequate standard of warmth. This is generally defined as 21ºC in the living room and 18ºC in the other occupied rooms - the temperatures recommended by the World Health Organisation," (DTI 2001, p.6).

The Government established the *UK Fuel Poverty Strategy* in 2001 (DTI 2001) which aimed to eliminate fuel poverty in all of Britain by 2010. Though fuel poverty seemed to decline initially, it has increased since 2004, which the Government attributes to rising fuel prices (DECC 2009a). Targets have since been revised, and the aim is now to eliminate fuel poverty in the whole of the UK by 2018, with varying targets set for each country of the UK (DECC 2009a).

In 2007, four million people were living in fuel poverty, with 3.25 million of those belonging to vulnerable groups, namely the elderly, the long term sick and disabled and those households with children (DECC 2009a). In order to decrease and eliminate the number of people living in fuel poverty, the Government is promoting energy efficiency through the Warm Front Scheme (in England), the Home Energy Efficiency Scheme (in Wales), the Energy Assistance Package (in Scotland), and Warm Homes (in North Ireland) as well as designating 'priority groups' in the Carbon Emissions Reduction Target scheme and in the Community Energy Saving Programme (DECC 2009a). An increase in energy efficiency can lead to a reduction in fuel bills, which can alleviate fuel poverty.[10]

2.3 UK household energy policies

In response to these policy drivers of energy security, climate change and fuel poverty, energy regulation and policy has evolved over time. There are three broad aspects of domestic energy consumption which polices aim to address: 1) the building industry and related supply chain, which is responsible for new-build houses and refurbishment of existing houses; 2) those manufacturers and designers who make energy-using products, such as appliances and heating systems (i.e. market transformation);[11] and 3) the householders themselves, who are the ones who are able, given the means, to purchase the more efficient products, buy new homes, and refurbish existing homes. Focusing on the latter, it is necessary to clarify the definitions of applicable terms. In the 1970s, a preferred term for addressing reductions in household energy use was

[10] The Government also addresses fuel poverty by offering Winter Fuel Payments to those over the age of 60 (DECC 2009a). Energy suppliers are also subject to voluntary commitments to assist those in fuel poverty (DECC 2009a).

[11] Market transformation focuses on product policy by way of a "strategic approach to making energy efficient products available" (Boardman 2004b, p.1923-1924). Market transformation functions at the industrial level by encouraging research and development, "support for innovative businesses and networks, social marketing to promote demand for high-efficiency technologies, certification, codes, quality assurance ratings, branding, and related efforts to secure legitimacy (and market share)" (Biggart & Lutzenhiser 2007, p.1073).

'energy conservation' (Schiellerup 2000). Energy conservation refers to reducing the amount of energy used through behavioural changes (Boardman 2004a). In the 1990s, the term 'energy efficiency' became more popular in policy documents (Schiellerup 2000). Energy efficiency is the reduction in energy use for the same output in energy services, or "the provision of given levels of services using less energy" (Toke & Taylor 2007, p.2131). For example, the energy efficiency of refrigerators increased by 175% between 1972 and 1993 (Geller & Nadel 2004),[12] offering the same level of utility in keeping foodstuffs cold. This is a technical change in the capacity for the refrigerator to do work given less electrical input, according to engineering and design standards. Energy conservation and energy efficiency at the household level both address energy consumption. Energy consumption is the amount of energy a unit consumes within a given unit of time. In the domestic sector, energy consumption constitutes the energy services of space heating, lighting, hot water heating, cooking and the use of appliances (Keirstead 2006).

It was not until the deregulation of the energy markets in the 1990s that policies specifically addressed consumer action for household energy conservation and efficiency.[13] The policies in the 1990s and early 2000s originally focused on reducing overall energy consumption, especially electricity and gas use, and have more recently been combined with climate change policy to focus on the reduction of greenhouse gases (Lovell et al. 2009). As summarised in Appendix A, many energy and climate policy measures address domestic energy efficiency, and a large portion of the policy aims were implemented through supplier obligations. From 1994, three waves of domestic energy reduction targets were established under a scheme called the Energy Efficiency Standards of Performance (EESoP), which was largely focused on targeting those in fuel poverty (Ofgem & EST 2003).[14] This was followed by the Energy Efficiency Commitment (EEC), which ran in two stages, from 2002-2005 (EEC1) and 2005-2008 (EEC2), requiring energy suppliers to encourage customers to reduce their energy use. The Energy Efficiency Commitment phases focused on household energy consumption for all households, but with requirements that 50% of those assisted should be 'priority groups' of those who were in fuel poverty (Ofgem 2005). Subsequent to 2008, the obligation is now called the Carbon Emission Reduction Target (CERT) and runs from 2008 until 2011 (DECC 2009b), and has recently been extended to

[12] The efficiency here was measured in the change of refrigerated volume per kilowatt hour per annum (Geller & Nadel 2004).
[13] The electricity market was privatised in 1989 (and the gas industry in 1986), though handled slightly differently in England, Wales, Scotland and Northern Ireland. By 1999, the energy regulators for gas and electricity were merged into one regulator (Office of Gas and Electricity Markets, Ofgem) in mainland Great Britain to ensure fair competition in these markets (Ofgem 2009a).
[14] Wave 1: 1994-1998, Wave 2: 1998-2000, Wave 3: 2000-2002 (Ofgem & EST 2003)

December 2012 (DECC 2010g). Forty percent of those assisted under CERT must be in 'priority groups'.[15] Table 2-1 compares each of the supplier obligations to date.[16]

Table 2-1: Summary of energy supplier obligations

Government obligation on suppliers	Time period	Savings (TWh)	Savings ($MtCO_2e$)	Achieved
EESoP	1994-2002 (in three phases)	19.9 TWh		20.7 TWh (Ofgem & EST 2003)[17]
EEC1	1 April 2002 – 31 March 2005	62 TWh		86.8 TWh (1.2 TWh carried over from EESoP 3) (Ofgem & EST 2003, p.43)
EEC2	1 April 2005 – 31 March 2008	130 TWh		185 TWh (35 TWh carried over from EEC1) (Ofgem 2008)
CERT	1 April 2008 – 31 March 2011 (extended to December 2012)		185 $MtCO_2e$	To date: 112 $MtCO_2e$ (total 149 $MtCO_2e$ including 55 TWh / 37.8 MtCO2 carry over) (Ofgem 2010a & Ofgem 2008)

These supplier obligations, along with building regulations and market transformation policies aimed at energy-using products, are meant to directly address householders' energy consumption. As seen in Table 2-1, the targets and measurements shifted from terawatt hours to million tonnes of carbon dioxide equivalent. Energy efficiency policy began in the 1990s by addressing energy consumption, but during the 2000s, energy and climate policy began to merge and targets shifted to those of greenhouse gas emission reduction (Lovell et al. 2009). The remaining target which directly focuses on energy consumption reduction stems from the *Energy Efficiency Action Plan 2007* which aims to save 272.7 terawatt hours (TWh) in total by 2016 (Defra 2007a),[18] 142.1 TWh of which is from the household sector. The 142.1 TWh is measured by summing the estimated energy savings achieved through implementation of certain regulations, including EEC1, EEC2, CERT, post-2012 supplier obligations and building and other regulations (Defra 2007a). Most other targets from the household sector are focused on carbon dioxide (or CO_2 equivalent) reductions. The Government estimated in its most current Energy White Paper, the *Low Carbon Transition Plan* (DECC 2009b), that household energy use "accounts for 13% of the UK's greenhouse gas emissions" (p.78), but states that these emissions need to be close to zero by 2050. The intermediary aim, between now and 2050, is for energy consumption rates to decline in the household sector in order to meet national policy targets of 29% reduction of CO_2

[15] CERT reduced the percentage of those in Priority Groups from 50% in EEC to 40%. The definition of those in priority groups was also changed to cover those over 70 years old (Ofgem 2008).
[16] Department of Communities and Local Government (DCLG) & DECC (2010) state that they will hold a "consultation on [the] shape of the post-2012 energy company obligation" (p.28).
[17] The total savings from EESoP was 21,099 GWh, but 366 GWh were attributed to non-domestic buildings. The number here only represents domestic savings.
[18] This saving (to take place between 2008 and 2016) is based on a five-year baseline period of 2001-2005, however, the Government is able to also take all consumption saved since 2000 into this target. (Defra 2007a)

emissions by 2020 on 2008 levels (DECC 2009b).[19] There were several provisions made in this most recent Energy White Paper regarding household energy efficiency, including:

> Increasing the Carbon Emissions Reduction Target (initially meant to run from April 2008 to March 2011, which has been extended to end of 2012) by investing 20% more money and increasing the expected CO_2 emissions savings from 154 million tonnes to 185 million tonnes.
>
> Establishment of a plan to roll out smart meters to every home by 2020
>
> Implementing a Community Energy Saving Programme to assist low-income families achieve greater energy efficiency levels
>
> Providing funding and information for community groups
>
> Helping vulnerable households by mandating a social price support and increasing Warm Front grant levels (DECC 2009b).

The UK Government expect that two-thirds of the emissions reductions from houses will be the result of the CERT extension, future obligations, as well as:

> "Heat and Energy Saving Strategy and supporting measures, Clean energy cash-back and Renewable Heat Incentive supporting measures, Smart metering and better billing, Zero carbon homes, Community Energy Savings Programme, [and] Additional product policy" (DECC 2009b, p.81).

A renewable heat incentive is planned for introduction in April 2011, encouraging shifts to low-carbon heat sources (DECC 2009b). Feed-in tariffs, which make payments to householders and communities who generate electricity from renewable sources, began on 1 April 2010 (DCLG & DECC 2010). The Heat and Energy Saving Strategy consultation was held in 2009 and resulted in the *Warm Homes, Green Homes* strategy document (DCLG & DECC 2010). The provisions of the Energy White Paper set a target to reduce carbon emissions by 29% from the household sector, equivalent to 24 $MtCO_2e$, the provisions only addressed part of this target, i.e. 20 $MtCO_2e$; *The Warm Homes, Greener Homes'* strategy document provided provision to address the missing 4 $MtCO_2e$. The strategy document has further indicated that every home should have loft and cavity wall insulation by 2015, where it is practical, and that "eco-upgrades" such solid wall insulation and heat pumps will be available for up to 7 million homes (DCLG & DECC 2010).

Another provision of the Energy White Paper, smart meters are meant to "provide a good platform for focusing the attention of the householders on their energy usage, and

[19] Achieving this intermediary aim in the domestic sector will contribute to the 34% emissions reduction target across all sectors by 2020 (compared to 1990 levels) (DECC 2009b).

... to consider the benefits of installing other measures in their home" (DCLG & DECC 2010, p.23). A smart meter replaces a normal electricity and / or gas meter, with the benefit of being able to send data back to the energy supplier every few minutes.[20] Smart meters also have energy displays attached that provide feedback on energy consumption and energy cost information to the householder. There is preliminary evidence to suggest that this form of information feedback to household customers will increase awareness and encourage reduction of energy consumption (Owen & Ward 2006; Darby 2010; Hargreaves 2010), however the estimated savings are still speculative. Trials for smart metering and more informative energy bills, amongst other initiatives, were recently conducted in the UK under the Energy Demand Reduction Programme (EDRP). In this trial, Government-supported research was conducted by four large energy companies on how to inspire energy reductions with smart meters and related feedback devices. The results of the energy measurements of the trials are meant to be available by spring 2011 (Shipworth 2010a). The intention is for every home to have a smart meter by 2020 (DECC 2009c).[21]

The Community Energy Saving Programme (CESP) was initiated in the Home Energy Saving Strategy and runs from 1 October 2009 until 31 December 2012. The CESP requires energy suppliers and electricity generators to reduce emissions by 19.25 million tonnes of carbon dioxide ($MtCO_2$) over the period (Ofgem 2009a). The focus is a 'whole house' approach, and includes not only energy efficiency measures, particularly for hard to treat houses (i.e. solid walls), but also microgeneration and district heating considerations (*The Electricity and Gas (Community Energy Saving Programme) Order* 2009). The CESP is to be applied to geographic areas of low-income (DECC 2009b).

The policies described here are the current priorities for reducing household energy consumption, but also act in conjunction with many established schemes, which are summarised in Appendix A, such as Warm Front, building regulations, the Code for Sustainable Homes and the Decent Homes standard.

2.3.1 Energy consumption

There are three ways to measure energy consumption: on a primary fuel input basis; an energy supplied basis; and a useful energy basis (MacLeay et al. 2009). The latter of these is not reliable enough for Government reports and is therefore not reported (MacLeay et al. 2009). The first, primary fuel input, "assesses the total input of primary fuels and their equivalents," which means that all energy lost in conversion is included

[20] Normal meters must be read by meter readers employed by energy companies or by the customers themselves, which is generally performed or requested on a quarterly basis throughout a given year.
[21] Recently, a prospectus was launched which indicates this date may be accelerated (Ofgem 2010b).

(MacLeay et al. 2009, p.20). As the energy lost in conversion by the whole energy structure is not particularly useful when comparing household consumption,[22] numbers presented in this chapter are based on an energy supplied basis, which "measures the energy content of the fuels ... supplied to final users" (MacLeay et al. 2009, p.20).

Energy consumption is measured by summing the total quantities of energy used by the household sector. As different fuels are measured in different units, these have generally been normalised in either terawatt hours (TWh) or millions of tonnes of oil equivalent (MtOe). In 2009, the UK domestic sector accounted for 28.5% of final energy consumption (DECC 2010a), or 43.6 MtOe. This includes 38% of all supplied electricity in the UK and 63% of total supplied gas (DECC 2010a). By comparison, the final energy consumption in the industrial sector in 2009 was 26.7 MtOe; 56.5 MtOe in the transport sector; and 17.1 MtOe in the agriculture, public administration, commerce sectors combined (DECC 2010c). Total consumption across all sectors decreased between 2008 and 2009 by 10.4 MtOe, largely due to a fall in gas consumption and to the recession (DECC 2010c). The fall in gas consumption was due to warmer weather in 2009 (DECC 2010d)[23] and due to the recession (DECC 2010e).

Table 2-2 outlines the amount of energy used in the domestic sector in 1970, 1990 and 2008 by end use.[24] Most comparisons of energy use are made between current levels and 1990 levels, as 1990 is the base year for achieving an 80% reduction in CO_2 emissions, as per the Climate Change Act 2008 (*Climate Change Act* 2008), and valid records are available from 1970, allowing analysis of trends. Currently, accounting for all fuel types, the majority of energy is used for space heating (57.6%). The next highest consumer in the domestic sector is water heating (23.7%), then energy for lighting and appliances (15.9%), and finally energy used for cooking (2.8%) (DECC 2010b).

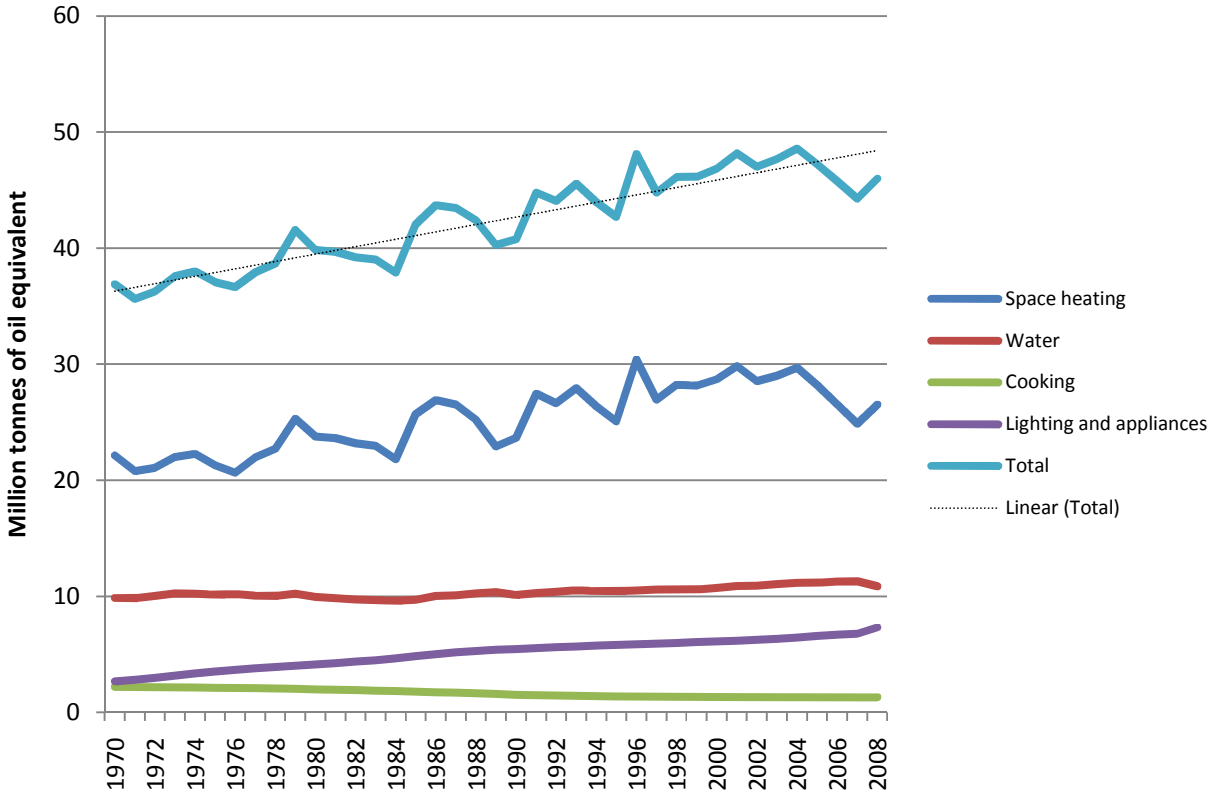
Table 2-2: Energy end use in the domestic sector in million tonnes of oil equivalent (MtOe) in 2008 (from DECC 2010b)

End Use Energy	1970		1990		2008	
	MtOe	Percent	MtOe	Percent	MtOe	Percent
Space heating	22.1	59.9%	23.7	58.1%	26.5	57.6%
Water heating	9.9	26.8%	10.1	24.8%	10.9	23.7%
Lighting & appliances	2.7	7.3%	5.5	13.5%	7.3	15.9%
Cooking	2.2	6.0%	1.5	3.7%	1.3	2.8%
Total	36.9	100.0%	40.8	100.0%	46.0	100.0%

[22] Final energy consumption in 2009 only accounted for 65.5% of primary demand, with losses occurring from losses in distribution (1.5%), use by energy industries (6.5%), net inputs for conversion (22.5%) and non-energy use (4%) (DECC 2010a, p.13).
[23] Summerfield et al. (2010) suggest weather, as well as energy prices, have been the primary cause of falling domestic energy consumption since 2006.
[24] 2009 data was not available for each end use category

Figure 2-1 charts the energy consumption by end use in the domestic sector. The trend line of the 'total' category indicates that energy consumption has been steadily increasing since 1970; between 1970 and 2009, domestic energy consumption increased by 18.2% (DECC 2010b).

Figure 2-1: Domestic energy consumption by end use, 1970-2008 (derived from DECC 2010b)



The largest increases in energy consumption, as per Figure 2-1, have been in the use of space heating and lighting and appliances. Space heating is the largest consumer of energy in homes. Though the trend has fluctuated, space heating has increased by an estimated 19.8%, comparing 1970 to 2008 (DECC 2010b). In the lighting and appliances sector, consumption has consistently risen; it is estimated that in 2008 houses used 174.7% more energy (7.3 MtOe) than in 1970 (2.7 MtOe) (DECC 2010b). Though these are generally upward trends,[25] the Government estimates that "had the savings through insulation and heating efficiency improvements from 1970 onwards not been made, then energy consumption in homes would be around twice current levels" (DECC 2010i, p.6).

[25] Energy used for cooking actually declined from 2.2 MtOe in 1970 to 1.3 MtOe in 2008 (DECC 2010b).

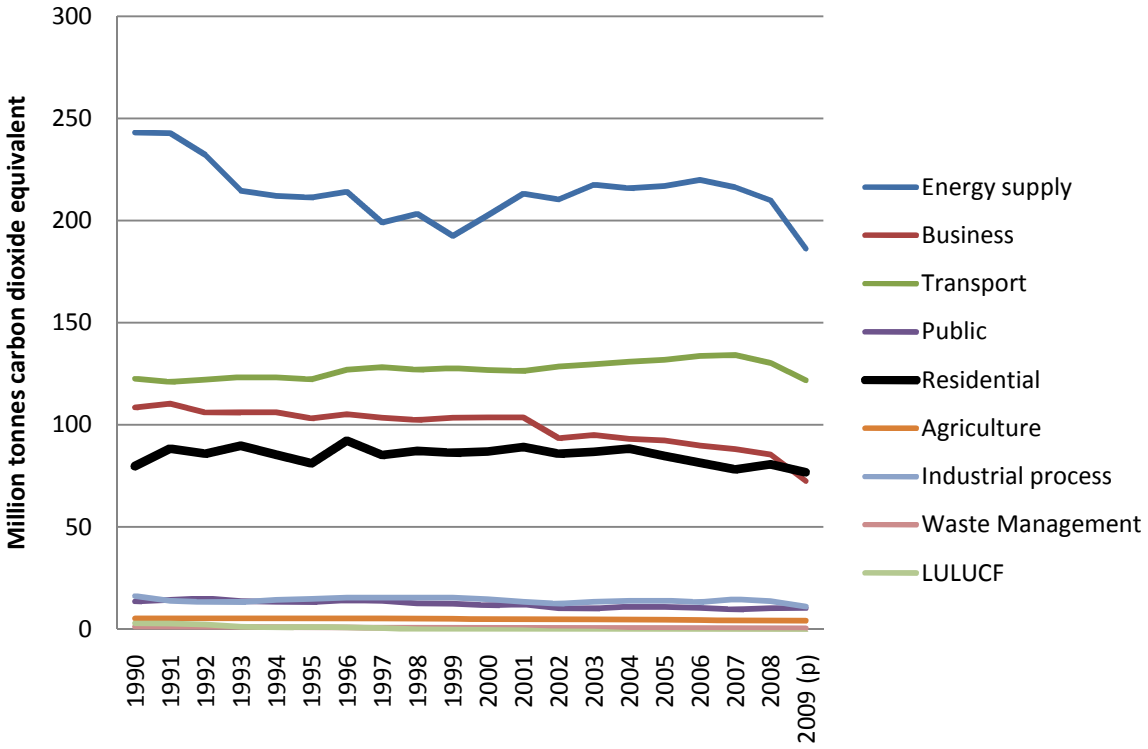
2.3.2 Carbon dioxide emissions

With the current focus largely on carbon dioxide emissions, this section briefly reviews the current and expected trends of carbon dioxide emissions. Though all greenhouse gas emissions are important, CO_2 accounted for 85% of all greenhouse gas emissions in 2008 (DECC 2010j) and emissions are consequently measured in CO_2 or equivalent units. Carbon, carbon equivalent, carbon dioxide (CO_2) and carbon dioxide equivalent (CO_2e) are common measurement units cited in policy documents, but not completely interchangeable.[26] The units examined here, based on the available statistical reports from Government and other sources, are in carbon dioxide equivalent (CO_2e) and carbon equivalent.

The latest emissions figures from the Government (summarised in Figure 2-2) indicate that emissions in the residential sector have fallen by 4% between 1990 and 2009,[27] with the domestic sector contributing to a total of 16% of all CO_2 equivalent emissions in 2009 (DECC 2010j). However, this is not without the following caveat: "it should be noted that emissions from this sector do not include emissions from power stations related to domestic electricity consumption" (DECC 2010j, p.7). This means that the black line in Figure 2-2 does not account for electricity, consumption of which was 22% higher in 2009 than in 1990 (DECC 2010j); it thus appears that a percentage of the CO_2e emissions are contained within the blue line in Figure 2-2, but there is no way to separate these based on Government statistical releases.

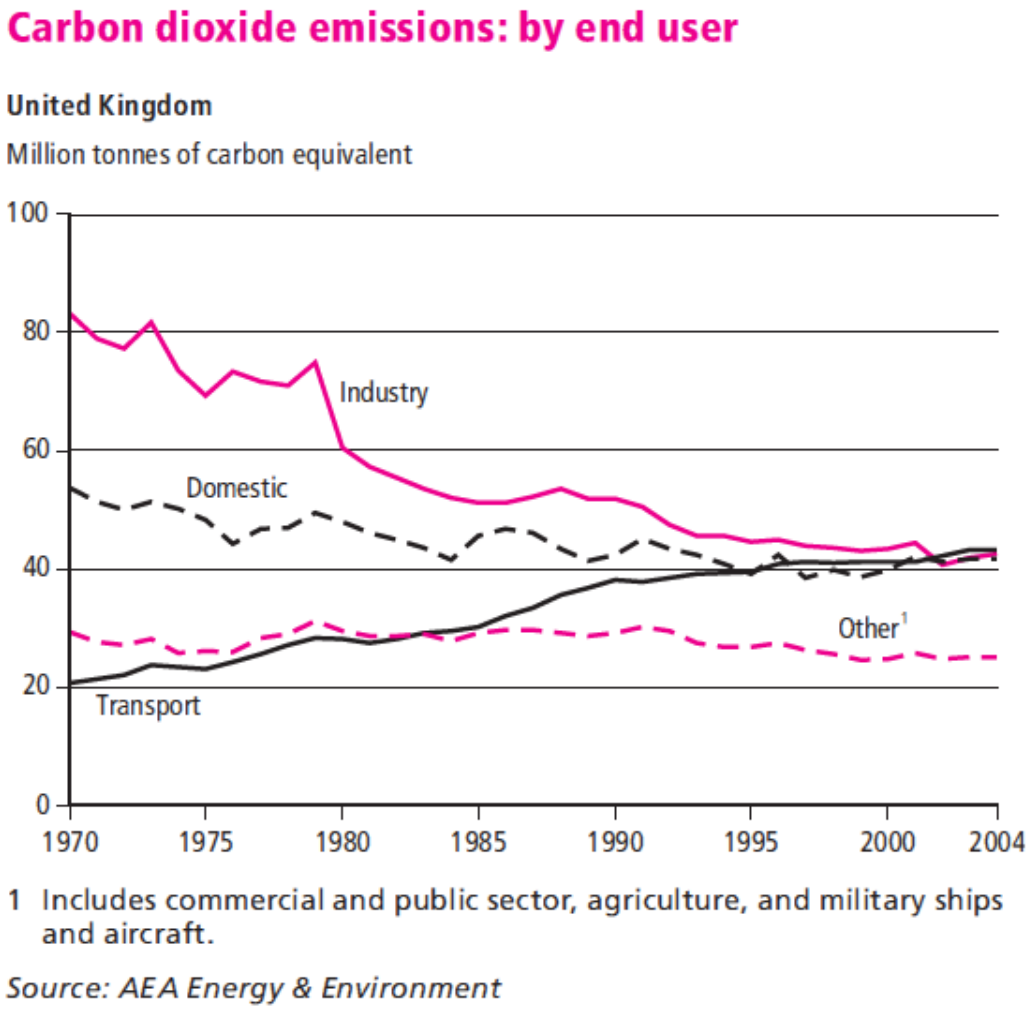
[26] For example, to convert carbon to carbon dioxide, units are multiplied by 44 and divided by 12 (Utley & Shorrock 2008). Carbon dioxide equivalent are calculated by multiplying all greenhouse gases by their Global Warming Potential (GWP) (AEA 2010): the conversion factor for CO_2 to CO_2e is 1.
[27] 2009 figures are still provisional

Figure 2-2: UK carbon dioxide ($MtCO_2e$) emission trends, 1990-2009 provisional(p) (DECC 2010h)



Another publication, however, did investigate emissions based on electricity emissions which have been allocated to the domestic sector; Figure 2-3 summarises trends between 1990 and 2004 in million tonnes of carbon (*not* CO_2) equivalent.

Figure 2-3: Carbon dioxide emission trends, 1970-2004 (from Self & Zealey (eds.) 2007, p.145)



Based on Figure 2-3, which *does* account for carbon emissions from electricity generation, the domestic sector accounted for approximately 27% of emissions in 2004 (Self & Zealey (eds.) 2007). This latter figure is more accurate in accounting for total emissions than DECC statistical reports (DECC 2010h). More recently, Utley & Shorrock (2008) estimated that the domestic sector emitted 38 million tonnes of carbon (Utley & Shorrock 2008), indicating a slight downward trend from 2004 (which is just above 40 MtC in Figure 2-3).

In general, the carbon dioxide emissions appear to be in a slight decline in the domestic and other sectors, though this is due largely to the recession, a fall in demand

(due to weather changes), and fuel switching[28] from coal and nuclear (DECC 2010j) and coal to gas (Shipworth 2010b). There is speculation that fuel switching from coal to gas had much more impact than, for example, weather-related changes (Shipworth 2010b), which would help explain the discrepancy between an increase in total household energy consumption by 12.9% between 1990 and 2009, and an apparent fall in CO_2 emissions by 4% (*not* accounting for electricity generation) in the same time period.

In order to meet goals of 29% reduction in CO_2 emissions from the domestic sector by 2020 on 2008 levels, the downward trend of emissions must continue. If the current downward trend has largely been based on fuel switching, future reductions will need to be based on cutting domestic energy consumption, regardless of weather related patterns. As the trend line in Figure 2-1 indicates that consumption is still on an upwards trajectory, this may require quite dramatic changes in order to meet Government targets.

2.4 Research approaches for understanding household energy efficiency

The UK Government has stated that:

> "Despite th[e] progress there is still significant and cost-effective energy-saving potential to be realised and most energy-use remains inefficient when compared with what is technically possibly and cost-effective" (Defra 2007a, p.9).

This statement summarises the approach that has been assumed in much policy since the 1970s (Lutzenhiser et al. 2009); policies presume that motivations for energy efficiency originate largely from the desire to reduce costs through technical means or behavioural changes. If technologies are available, as the Government claims (Defra 2007), but household-level consumption is not declining, it may be that the financial cost of technologies is too great, prohibiting diffusion. There is recognition that costs can be prohibitive (Defra 2007a), but disposable income has rapidly risen (DECC 2010l) and the Government has indicated that there are still many cost-effective measures available, particularly in existing dwellings (Defra 2004). Further, there are indications that the perceived and actual costs of energy are not always the primary motivators for efficiency. Those with similar incomes (and houses of similar building fabric) can show considerable difference in energy use (Lutzenhiser 1993; Aune et al. 2002) which means ability to afford energy saving measures does not necessarily influence efficiency. Wilhite et al. (2000) indicate that energy consumers are less

[28] Coal emits far more carbon dioxide emissions than nuclear or gas (Shorrock 2000).

concerned about price or cost-minimisation than about comfort and convenience. The conclusion, as stated in the *UK Energy Efficiency Action Plan 2007*, has been that the 'obstacles' to energy efficiency include not only hidden costs, lack of awareness and wrong information, but also "irrational consumer behaviour" (Defra 2007a, p.19). The concept of rationality implies a neo-classical economic view which assumes that consumers with complete information will make the most economically sensible decisions regarding energy use (Dyner & Franco 2004). The irrationality, therefore, is generally attributed to lack of information (or lack of awareness) and real or perceived financial constraints.

2.4.1 Dominant paradigm

The consideration of technology through an economic lens is the dominant paradigm in energy policy (Guy 2006; Biggart & Luztenhiser 2007; Lutzenhiser et al. 2009). This is sometimes referred as the physical–technical–economic model (PTEM) of household energy consumption (Keristead 2006; Lutzenhiser et al. 2009). Adherents to the PTEM model, particularly in the UK and Europe (Lutzenhiser et al. 2009), often refer to discontinuity between energy efficiency expectations and actual results as the 'energy efficiency gap' (Jaffe & Stavins 1994; Weber 1997; Koopmans & Velde 2001; Keristead 2006). The 'energy efficiency gap' is generally attributed to an "information deficit" (Lutzenhiser et al. 2009, p.41) which means consumers are either unaware of opportunities for reducing household energy consumption or do not understand. There is an assumption that consumers will adopt energy efficiency measures "once [they] become aware of the benefits" (Stern 1992, p.1224). The conventional method of understanding the cost of household energy use in the UK is through quarterly energy bills. The PTEM assumption would be that a household consumer will notice the cost of energy bills and want to reduce them by changing energy use patterns, and that it will be linked with the ability to afford changes. However, there are many who state that the principles of the PTEM and adherence to addressing the 'energy efficiency gap' ignore "wider structural and cultural issues" (Palmer et al. 2007, p.1) and that PTEM policies are subject to "blind spots" (Stern 1986).

2.4.2 Social research approaches

Social and consumer research in the area of energy conservation and efficiency on a household level began in earnest in the 1970s, after the OPEC oil embargo (Gaskell 1983). Findings indicate that social marketing, "when coupled with other policy initiatives and motivating events, might be expected to produce energy savings in the neighbourhood of 10 percent" (Lutzenhiser 2002, p.55). There has been an example of a 15% decrease in energy consumption in a community in Oregon in 1983 using a

"comprehensive, multipronged social marketing strategy" (Luztenhiser 2002, p.52), a result which has rarely been achieved again (Luztenhiser 2002). However, if householder action is only partially influenced by basic economic information, it has been argued that social sciences, such as psychology and sociology, may have significant contributions to make in addressing the 'blind spots' in the policies addressing household energy consumption (Winett & Ester 1983; Stern 1986; Stern 1992; Keirstead 2006; Dietz et al. 2009).

Psychological studies of household energy use tend to focus on attitudes (Lutzenhiser 2002), personal motivations for energy behaviour such as guilt, satisfaction and moral responsibility (Keirstead 2006), and methods of changing behaviour through social marketing (MacKenzie-Mohr & Williams 1999; Luztenhiser 2002, p.53). Regarding attitudes, it was the belief of the Fishbein & Ajzen (1975) 'Theory of Reasoned Action' model that attitudes precede intentions, which are predictors of behaviour. Both attitudes and behaviour are "outcomes of a cognitive balancing of the actor's attitudes with the influences of his or her social environment" (Lutzenhiser 2002, p.53). Many studies, particularly in the 1970s and 1980s, thus tried to follow this approach, investigating changes in attitudes and subsequent changes in behaviours (Shipworth 2000), though results were often contradictory (Aune et al. 2002). Seligman et al. (1978), for example, found that attitudes, particularly of personal comfort and health concerns, predicted over 55% of the variability of summertime electricity consumption in a survey of householders in Twin Rivers, New Jersey. Anderson & Rose (1986) measured the intentions of householders to convert their space heating, finding that intentions to switch accounted for "only" 42% of actual space heating conversions (p.268), indicating the relationship between intentions and actions did not appear to be a direct one. MacKenzie-Mohr & Williams (1999) review a sample of studies in this area and conclude that there may be a relationship between attitudes and behaviour toward household energy use, but empirically the relationship is weak.

The limitations of the attitude and behaviour models were addressed in one social-psychological theory called the VBN theory (values – beliefs – norms), which states that "personal moral norms are the predispositions to proenvironmental action" (Stern 2000, p.413), which are themselves based on a person's values and beliefs. Stern et al. (1999) indicated that a survey of self-reported environmental beliefs and actions of Americans yielded results suggesting that the VBN model could account for a good amount of variance in environmental policy support (35%) and environmental citizenship (30%), though rather low variance in committed activism (Stern 2000, p.416). Other psychological and social-psychological studies of household energy

efficiency suggest that energy reduction can be encouraged through personal tailored information (Borgida & Nisbett 1977; Coltrane et al. 1987; Abrahamse et al. 2005), commitment from householders (Abrahamse et al. 2005), the offer of rewards, provision of feedback (Abrahamse et al. 2005; Abrahamse et al. 2007) and the influence of social norms (Cialdini 2003). The empirical work in this area largely focuses on increasing awareness and knowledge. Increasing awareness is also a tenet of the PTEM approach, but instead of using a broadbrush approach, psychologists attempt to shift the focus so that householders are considered as unique individuals in their social context. "Information is more likely to change behavior if it is specific, vivid, and personalized" (Stern 1986). Ambrahamse et al. (2005) reviewed the empirical evidence on several psychological and social psychological approaches and found that rewards, for example, often worked but were short-lived, and that feedback was useful if it was provided frequently. Further, Ambrahamse et al. (2007) found that a combination of tailored information, goal-setting (aiming for 5% energy savings) and tailored feedback given to Dutch householders led to a total savings of 5.1% in the experimental group, as compared to an *increase* in energy use in the control group.

Psychological approaches have yielded novel processes for both studying energy consumption and applying methods to encourage energy consumption reductions, but critics indicate that strict psychological approaches focus too closely on the individual, neglecting the understanding and influence of the social system (Keirstead 2006). Social psychological studies attempt to contextualise behaviours, still using the individual as the unit of analysis, but firmly root individual behaviour in the context of norms, values and a social system (Costanzo et al. 1986; Jackson 2005; Schultz et al. 2007). It is thought that if normative messages are made clear, for example, it will be commonplace for others to follow. A certain level of specificity is needed in these messages, according to Midden & Ritsema (1983): "Change programs which aim to use normative processes should ... distinguish between specific behaviors and not regard energy conserving behavior as one homogeneous set of behaviors" (p.53). The messages must also be consistent. As Cialdini (2003) and Schultz et al. (2007) describe, social marketing techniques can backfire if there are conflicting messages embedded within one marketing campaign.[29] Attention to these types of details by social psychologists thus might act to refine social marketing efforts, making them more effective and ultimately achieving reductions in consumption.

[29] If the message promoted is that 'many people are wasting energy which is ruining the world,' recipients of the message will not necessarily focus on the desire to stop 'wasting energy' (the intended injunctive norm of the message) so much as the 'many people are doing this' (the unintended descriptive norm). There is a tendency for people to yield to perceived normative pressure (i.e. those gathered from descriptive norm messages), which can defeat the purpose of a marketing campaign (Cialdini 2003; Schultz et al. 2007).

Placing energy use in the wider context of daily social duties and interactions, sociological approaches also focus on social and cultural influences of energy use, including lifestyle choices (Lutzenhiser et al. 2009). Lifestyle studies focus on "distinctive modes of existence that are accomplished by persons and groups through socially sanctioned and culturally intelligible patterns of action" (Lutzenhiser & Gossard 2000, p.215). By implication, if lifestyle choices of saving energy are recognised "patterns of action" (Lutzenhiser & Gossard 2000, p.215), then everyday actions must somehow be recognised and emulated. In British study of lighting practices, Crosbie & Guy (2008) found that "lighting choices made by householders tend to co-evolve with the household lighting practices portrayed by the media" (p.220). They further found that lighting in British homes is linked to culturally-determined ideas of "mood" and "well-being" (Crosbie & Guy 2008, p.231). Similarly, in a cross-cultural ethnographic study of daily energy-using activities in Japan and Norway, Wilhite et al. (1996) discovered that energy-intensive practices were linked to cultural meanings of "cosiness," particularly in Norway, and health and cleanliness in Japan (p.803). Social practices[30] and cultural norms are thus integrated elements in structuring how people think about energy and use it. This parallels the social construction of technology (SCOT)[31] model, which focuses on the meanings imposed on objects or artefacts, "culturally constructed and interpreted" by a social group (Pinch & Bijker 1987, p.40). The SCOT approach was the precursor to theories on socio-technical change (Bijker 1995). Socio-technical studies of household energy consumption attempt to avoid technological determinism, avoid an individualist approach, "and, critically, refuses to distinguish prematurely between technical, social, economic, and political aspects of energy use" (Guy 2006, p.650). Bijker (1995) indicates that socio-technical change theories:

> "... should combine the contingency of technical development with the fact that it is structurally constrained; in other words, it must combine the strategies of actors with the structure by which they are bound" (p.15).

The socio-technical approach emphasises the integrated issue of people (i.e. the social world) and technology, rather than viewing them as distinct entities that can be handled separately, with the "... *socio* element of sociotechnical change typically refer[ring] to the fact that innovations are shaped by social processes" (Shove & Walker 2010, p.471). As Burke (2006) further indicates, "the diverse social and technical parts are

[30] Warde (2005) indicates that "consumption occurs as items are appropriated in the course of engaging in particular *practices*" (p.131, emphasis added).
[31] Bijker (1995) identifies SCOT as one of three models "within the constructivist research program" of technology, the others being "the systems approach [and] the actor-network approach" (p.6).

interconnected in the sense that the absence of, or change in, one will affect others" (p.34).

Sociological studies are often based on qualitative data, which has received criticism due to the lack of quantitative data (Goldblatt 2005; Keirstead 2006), as it might inhibit recognition from the dominant PTEM-focused policymakers. There are also criticisms that sociological energy studies are too broad in their applications, creating difficulty for translation into policymaking (Shove 1998). In order to facilitate the translation of social research into policymaking, several authors have reviewed the contemporary approaches to consumer behaviour, discussing further interdisciplinary approaches (Wilson & Dowlatabadi 2007; Faiers et al. 2007) and integrated frameworks (Lutzenhiser 1992; Keirstead 2006) which focus on household energy consumption, particularly with increasing interest in behavioural economics, practice approaches and theories of co-provision (Faiers et al. 2007; Lutzenhiser et al. 2009).[32] As Faiers et al. (2007) conclude:

> "In advance of a model being developed that can identify causal relationships between the three central factors of the adoption decision, i.e. the product, the individual and the environment in which they are placed, policy makers should be more aware that carbon reduction targets will rely on individuals using energy efficiently and those individuals operate in a social context and the influence of cultural, social and emotional influences cannot be underestimated. To that end, it would appear that the issue of learning and awareness, coupled with accessibility to simple technologies would be a central factor to formulating effective policy" (p.4389).

Information and awareness are part of the UK aims in increasing household energy efficiency, but embedding this awareness in social, institutional, cultural and emotional contexts, just as the socio-technical change approach suggested, makes the socio-technical approach an appealing framework for the study of household energy efficiency.

2.4.3 Diffusion as an approach within a socio-technical framework

Focusing on the issues of information and learning within the socio-technical framework could yield practical results for assisting policymakers. A specific application of information communication for encouraging household energy efficiency is found in the diffusion of innovation theory. The diffusion of innovations considers technical innovations as they are adopted, or not adopted, by means of communication within a social system (Rogers 2003). It is a process of innovation dissemination that occurs

[32] However, in Keirstead's (2006) review of the field, he "observes greater emphasis on disciplinary approaches in recently published studies" (Lutzenhiser et al. 2009), particularly from the UK.

over time. Practically, the diffusion of innovations is a theory that is particularly popular in marketing (Bass 1969; Rogers 2003) and can be translated into policy terms; products and policies are designed with the specific intention of having people buy or adopt them. It is understandable that energy efficiency policymakers and practitioners would want to understand and promote the elements of diffusion, i.e. the physical or behavioural innovations, the communication channels, the social system within which it diffuses, and the time it takes to reach targets. However, there are certain assumptions in the theory which must be recognised. For example, one supposition of the diffusion of innovations is that the social norms and habitual activities surrounding energy consumption are relatively stable, or continuous, within a given social context; that is, diffusion "does not necessarily change the circuits of reproduction that hold it in place" (Shove & Walker 2010, p.474). This perhaps overlooks the possibility for broader social changes, but the isolated attention given to the interaction between the energy-reducing innovations and information-seeking provides a useful theoretical foundation on a topic which has received little empirical attention (Rambo & Feldman 2003).

2.5 Conclusion

With Government targets of reducing carbon emissions from the domestic sector by 29% in the next ten years, and general trends which do not indicate this aim will be achieved, there is a practical need to understand the changes necessary for reducing household energy consumption. The Government has stated that technical innovations are available for achieving reductions (Defra 2007a), but also state that householders do not 'rationally' adopt these innovations (Defra 2007a), for reasons that may extend beyond financial constraints (Wilhite et al. 2000). Psychological, social psychological and sociological approaches to understanding household energy consumption have demonstrated that householders are often motivated by very specific, vivid information and through tactics such as goal-setting, which is incorporated in certain social marketing techniques (Stern 1986; Abrahamse et al. 2005). A socio-technical approach to changes in household energy use assumes that the technical elements which are possible for achieving energy savings cannot be considered without the social, economic, and cultural context of diffusion. This makes the socio-technical approach a useful framework for investigating more specific issues of the diffusion of energy-reducing innovations.

Chapter 3: DIFFUSION OF INNOVATIONS

3.1 Introduction

The diffusion of innovations, or "the process by which an innovation is communicated through certain channels over time among members of a social system" (Rogers 2003, p.5), can be applied as a theoretical framework for understanding the technical and social processes of achieving household energy reduction. The four main elements encapsulated in the diffusion of innovations are: 1) the innovation, i.e. an idea, item or practice, 2) the time frame in which it takes place, 3) the social system, e.g. an organisation or nation, and 4) the communication channels through which the diffusion takes place, e.g. interpersonal networks or media. The process involves individual cognition and decisions of the potential adopter, which Rogers (2003) calls the 'innovation-decision process.' This process is "essentially an information-seeking and information-processing activity in which an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation" (p.172). There are five stages of this process, namely 1) knowledge of an innovation; 2) persuasion toward using it; 3) the decision to adopt or reject; 4) implementation and use; and 5) confirmation of the decision. Communication of the message of the innovation from external sources is important throughout this process.

This chapter reviews the literature on the diffusion of innovations, first briefly explaining the history and development of the theory. The next section explains the four elements of the diffusion process using examples from the literature on household energy use. This is followed by an examination of the 'innovation-decision' process. Critiques and alternatives to diffusion theory are then discussed, and implications for this research identified. The review of theory and empirical research leads to the conclusion that the diffusion of innovations is a useful approach for understanding the particular utility of social networks for the diffusion energy efficiency technologies and behaviours.

3.2 History and development of diffusion theory

Everett Rogers produced the seminal review and critique on the subject of diffusion in his 1962 book, *Diffusion of Innovations*, with subsequent editions in years 1971, 1983, 1995 and 2003. As Rogers (2003) and Dearing (2008) explain, the ideas behind the diffusion of innovations can be seen in literature dating back to 1903 in Gabriel Tarde's book *The Laws of Imitation* which examined innovations diffusing through social systems. Tarde (1903) discussed the social being as "imitative" (p.7) and repetitive with regards to "invention" (p.2). Georg Simmel, a German political philosopher, was

also investigating similar theories in the same time period, though focused more specifically on the social connections necessary in diffusion (Dearing 2008). Simmel's "contribution ... was the forerunner for understanding how social network position affects what individuals do in reaction to innovations and when" (Dearly 2008, p.101). Following the work of these two men, sociologists and anthropologists began to conduct diffusion studies in the 1920s and 1930s on information communication and the spread of ideas and innovations from urban to rural areas (Dearing 2008). The dedicated theory of the diffusion of innovations really began in earnest, however, in the 1940s (Valente & Rogers 1995; Rogers 2003; Dearing 2008), particularly with the work of Bryce Ryan and Neal Gross, which set out the "basic paradigm for diffusion research" (Rogers 2003, p.46). Ryan and Gross were rural sociologists who studied the diffusion of a hybrid corn seeds, particularly focusing on the influence of social messages as evidenced by the full or partial adoption of the innovative corn seed in two communities in the state of Iowa, USA. They concluded that salesmen were influential in spreading information, but that acceptance only came when farmers then confirmed the information with neighbouring farmers (Ryan & Gross 1943). Subsequently, in the 1950s, there was an "explosion" of diffusion studies within the discipline of rural sociology (Rogers 2003, p.56).[33]

Other disciplines began using the theory shortly after the Ryan & Gross (1943) publication. The public health and medical sociology diffusion studies began in earnest in the 1950s and have remained popular (Rogers 2003).[34] During the 1960s, diffusion theory applications became popular amongst the disciplines of "public health, economics, geography, marketing, political science, and communication" (Valente & Rogers 1995, p.264). Bass (1969), for example, was influential in adapting the diffusion paradigm for market research, establishing the Bass model (Dyner & Franco 2004). This model sought to understand the implications of communication channels, largely word-of-mouth messages, with the aim to increasing product sales, though did not examine characteristics of the innovation itself (Dyner & Franco 2004).

[33] Diffusion studies in this field eventually declined in the 1960s (Valente & Rogers 1995), more due to changes in the subfield of rural sociology than the diffusion traditions losing an audience.

[34] An often cited work in medical sociology is the research based on Coleman et al.'s (1957) study of doctors' prescriptions of the drug tetracycline, in which the authors examined the propensity for general practitioners to prescribe the drug as a result of their professional colleagues having also done the same. They concluded that once a threshold of social network members had adopted the habit of making tetracycline prescriptions, the general practitioner would then start prescribing it. In a subsequent publication (i.e. Katz et al. 1963), the same authors gave a parallel account of diffusion research in medicine as to that in rural sociology (Valente & Rogers 1995). This publication and the publication of Rogers' first edition of *Diffusion of Innovations* provided evidence of the applicability of diffusion research, and contributed to the growth in other fields (Valente & Rogers 1995).

The diffusion of innovations is essentially a way of structuring the conception of the process of purposive change. It was developed as an "accounting scheme" (Katz et al. 1963, p.251) and a mechanism to explain the process of social and technological changes. As Valente & Rogers (1995) indicate, Ryan and Gross were the first to develop the model of the innovation-decision process which involved "awareness, trial and adoption; ... the roles of information sources/channels about the innovation; ... the S-shaped rate of adoption, a curve that was tested as to whether it fit a normal distribution; and ... the personal, economic, and social characteristics of various adopter categories ..." (p.249). The immediate popularity of the diffusion theory led to many studies which sought to apply, test and alter the initial aspects. For example, George Beal and Joe Bohlen further developed the five stages of the innovation-decision process, expanding awareness, trials and adoption to: "(1) awareness, (2) interest, (3) evaluation, (4) trial, and (5) adoption" (Valente & Rogers 1995, p.255). Subsequently the same authors drew up a classification for adopters which included the categories of "innovators, ... early adopters, ... early majority, ... majority, and .. non-adopters" (Valente & Rogers 1995, p.255). Katz et al. (1963), in a review of diffusion studies to that point in time, characterised diffusion as the:

> "(1) acceptance, (2) over time, (3) of some specific item - an idea or practice, (4) by individuals, groups or other adopting units, linked (5) to specific channels of communication, (6) to a social structure, and (7) to a given system of values, or culture" (p.240).

These definitions encapsulated the "classical diffusion paradigm" (Dearing 2008). Roger's (2003) latest version is still very similar, with small differences. For example, Rogers' (2003) definition avoids the statement of 'acceptance' which Katz et al. (1963) included, as it is evident that people may not accept or adopt an item or innovation, and further many not even be aware of it.

The classic diffusion model is still widely applied in research, but there is now recognition that the underlying assumptions have changed as society has changed (Rogers 2004). Dearing (2008) sees diffusion research as evolving into the "science of dissemination" (p.106), due to a growing focus on organisations, social network theory and a societal sector perspective (rather than locationally-based). As well, the increase in multi-media messages have lead to a multiplication of channels through which to receive information on an innovation, rather than simply through word-of-mouth and print, radio or television advertising. The changing opportunities for dissemination have thus added more dimensions to applications of research on the classic diffusion model.

3.3 Elements of the diffusion of innovations

As stated above, the diffusion of innovations is most often defined as “the process by which an innovation is communicated through certain channels over time among members of a social system” (Rogers 2003, p.5). This section looks at each element: first the innovation, then time, then the social system, and finally communication networks.

3.3.1 Innovation

An innovation can be an “idea, practice or object that is perceived as new by an individual or other unit of adoption” (Rogers 2003, p.12). The innovation does not need to be unknown or novel within a social system, but has a “newness” for the adopter (Rogers 2003, p.12). Innovations can be practices, behaviours, policies and ideas, innovations but are quite often regarded as objects and technologies. Rogers (2003) rather broadly defines technology as “a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome” (p.13). Though it is possible to conceive of technology actually *increasing* a user’s uncertainty, the implication is that adoption of technology items involves some kind of change.

Rogers (2003) explains that innovations tend to succeed if they 1) have a relative *advantage* over the predecessor, 2) are *compatible* with values and experiences, 3) are not too *complex*, 4) able to be *trialled* and 5) have *observable* results. These attributes are often the focus of diffusion studies which examine household energy-reducing innovations, yielding important findings for energy efficiency practitioners.

3.3.1.1 Advantage

Rogers (2003) defines relative advantage as “the degree to which an innovation is perceived as being better than the idea it supersedes” (p.229). Rogers indicates that new innovations tend to succeed and be considered ‘better’ if they have specific types of advantages over previous innovations, such as economic or social prestige advantages. The concept of economic advantage, in particular, is used to promote energy-reducing innovations (Lutzenhiser et al. 2009). However, as explained in Chapter 2, the rational action of financial savings is not a predictable ‘advantage’ of energy-reducing innovations (Darley 1978; Wilhite et al. 2000; Aune et al. 2002). For example, in a study of the adoption of energy efficiency measures amongst New Zealand householders, Ball et al. (1999) found that financial attributes, i.e. monetary savings, did not differentiate adopters from those who rejected compact fluorescent lights. Financial savings appear important, but not at the adoption stage:

> "For adoption, the perceived financial attributes were not significant ... suggesting that financial attributes lead to consideration of the device but are not a barrier at the adoption stage" (Ball et al. 1999, p.127).

In a detailed study of solar power installations by homeowners, Faiers & Neame (2006) found that the perceived relative advantage of solar power over mains electricity was quite weak, due to uncertainty surrounding payback, grant support and visual attractiveness, which all acted against adoption. Extrapolating to energy efficiency innovations, it again appears that economic advantage is simply one of many attributes to consider. Rogers (2003) indicates that social prestige could be another of the advantageous attributes to consider.[35] In a study which examined the adoption – or non-adoption – of water-minimising innovations in suburban Australia, Askew & McGuirk (2004) found that social distinction and social conformity actually led to the increased use of water in gardening, or the non-adoption of water-minimisation innovations and techniques. There was higher social prestige in having a nice garden that was well-watered than in adopting minimisation techniques in a time of water shortages. There are few studies on the influence of social prestige on energy efficiency, but the influence of existing social networks, which may carry prestige factors, has been theorised as important in the social diffusion of energy conservation programmes (Coltrane et al. 1986).

3.3.1.2 Compatibility

Rogers (2003) defines compatibility as "the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (p.240). The determination of compatibility can assumedly work hand-in-hand with 'advantage,' as the advantage of one innovation might be that it meets established expectations. However, most studies distinguish between 'advantage' and 'compatibility' by assigning cost to the 'advantage' category and personal preferences to the 'compatibility' attribute of an innovation. For example, Menanteau & Lefebvre (2000) reviewed the diffusion of compact fluorescent lights and indicate that they are incompatible with expectations built up around incandescent bulbs, namely in the time they took to reach full lumens, even though they have a competitive economic advantage in the long term. Vollink et al. (2002) empirically tested Rogers' attributes of innovations with an energy distribution company's 'Environmental Action Plan' co-ordinators who made decisions about the type of energy efficiency offers which would be offered to householders. The authors measured compatibility of a new energy efficiency programme by asking if it aligned with former processes and current

[35] Rogers (2003) mentions 'social prestige,' with regard to advantage, but largely in terms of 'fads' with clothing or cars. Though social prestige is perceived through social networks, there are other causal mechanisms to consider, such as social influence, social support, etc.

programmes.[36] They found that compatibility was a strong predictor of the intention of householders to adopt energy efficiency measures, though only if the energy efficiency intervention first showed a significant advantage in terms of cost and effectiveness in saving energy. Though this is an organisational example, it appears that compatibility of energy-reducing innovations would be an important factor in their diffusion, possibly in combination with the innovations relative economic advantage.

3.3.1.3 Complexity

Rogers (2003) indicates that complexity is the "degree to which an innovation is perceived as relatively difficult to understand and use" (p.257). Rogers (2003) further indicates that complexity is negatively related to its adoption; the more complex an innovation, the less likely it is to be adopted. Vollink et al. (2002) confirm this with regard to the diffusion of load management in washing machines within the same energy distribution company mentioned above; the complexity of encouraging load management to householders made the 'Environmental Action Plan' co-ordinators of the energy distribution company less likely to encourage that measure. The issue of complexity is given very little attention by Rogers (2003), but could have important implications for energy-reducing innovations, particularly new technologies such as energy display devices. In a qualitative study of the acceptance of smart meters in the UK, Hargreaves (2010) indicates that householders often wanted more information regarding smart meters, but appeared uncertain as to where to find the information. The implication is that the smart meters were not perceived as easy to understand, holding a certain degree of complexity. If there is no information to help ease the degree of complexity, it may be that this attribute of the innovation prevents full adoption.

3.3.1.4 Trialability

"Triability is the degree to which an innovation may be experimented with on a limited basis" (Rogers 2003, p.258) and involves either directly or indirectly trying out the innovation. This would occur in the implementation phase of the innovation-decision process. Regarding energy efficiency technologies, it is not always easy to trial innovations that require a full commitment, particularly if they involve structural changes to a building. Innovations such as cavity wall or loft insulation or replacement of a heating system cannot easily be undone (Howell 2010). Sometimes people must indirectly trial innovations, or use a substitute for a full trial. Darley & Beniger (1981) review a study of California homeowners who 'trialled' solar thermal heating for homes

[36] Compatibility was measured with three questions: 1) is the new programme consistent with the company's energy conservation objectives? 2) is it deemed to be a successful strategy, based on past experience? and 3) will it work well with programmes already in place? (Vollink et al. 2002)

by first installing solar thermal heating in their swimming pools. If the householders liked it, they then considered it for their home. Unlike renewable energy and other more visible innovations, energy efficiency is 'invisible' (Shove 1997). The only manner to view energy reductions is for householders to examine bills or receive some sort of feedback. Ball et al. (1999) indicate that personal communication is an important means of 'trial by others' for energy efficiency. If others have tried a low-energy light, the personal recommendation can substitute for an actual trial. Or low-energy lights can actually be borrowed. For example, in the UK, a company created a 'light bulb library' of low-energy bulbs which organisations can acquire and then lend to householders to try them for a short period.[37]

3.3.1.5 Observability

When Rogers (2003) discusses observability, it does not refer to the results which are observable to the adopter. Rather, observability is "the degree to which the results of an innovation are visible to others" (Rogers 2003, p.258). The observability is meant to alleviate perceived complexity, helping householders to confirm the decision of the energy efficiency adopter through comparison to a "social reference group" (Shipworth 2000, p.80). Social acceptance by others sends normative messages which persuade the householder toward adoption. With regard to energy efficiency, this can be a problematic task. It is often difficult for others in a social system to physically 'see' household energy efficiency innovations of an adopter (Midden & Ritsema 1983). One way to have an observable adoption is to speak to others about it. The people who a householder speaks with are 'trialling by others,' and the adopters themselves are confirming their decisions. Pallack et al. (1980) conducted an energy efficiency experiment with householders in Iowa, USA, on this topic. The authors approached householders, half of whom were encouraged to make a private commitment to reduce energy use (anonymity was assured) and the other half of whom were asked if their names could be publicised as having taken part in the study, i.e. they were asked to make a public commitment. Changes in heating and air conditioning use were the measures specifically encouraged. The researchers never actually publicised the names of the experimental group, but the results were that that this group "used 15% less natural gas and 20% less electricity" (Dennis et al. 1990, p.1111), due to perceived observability. Further, this group that agreed to the publicity were still making significant reductions in electricity use after 12 months (Pallack et al. 1980). It appears that this group were influenced to persist in the adoption of energy-reducing behaviours at least partially due to the fact that they thought others were aware of their actions.

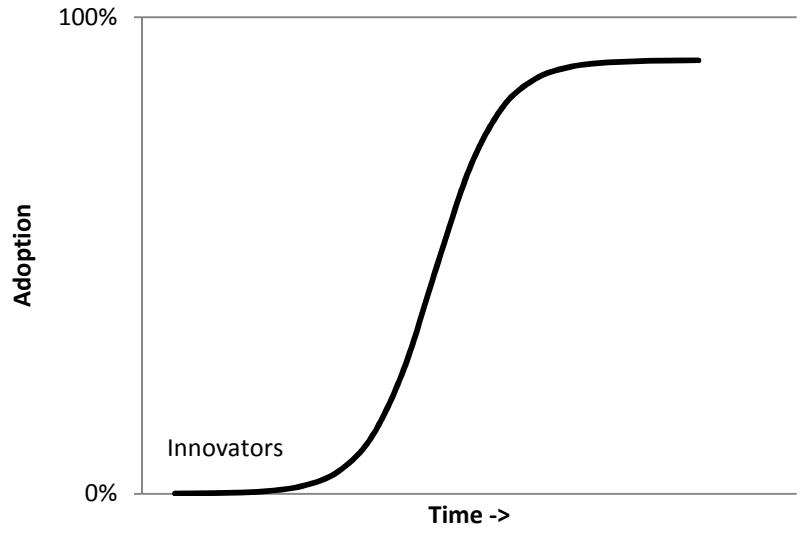
[37] The company Eco-St has a light bulb library which consists of about 40 low-energy lights which are displayed in a briefcase-type container (http://www.greenwisebusiness.co.uk/news/library-sheds-light-on-low-energy-bulbs.aspx) [Accessed 3 July 2010]

The five innovation attributes mentioned here are meant to explain 49-87% “of the variance in the rate of adoption of innovations” (Rogers 2003, p.221), though it has been noted that this variance is based on experiments done in the 1960s that all focused on agricultural innovations (van Rijnsoever et al. 2009). Several studies have confirmed the utility of these five innovation attributes in other fields (Yakel & Kim 2005; Hashem & Tann 2007). However, others have tested the variables against other adoption measurements and found only slightly better results using the diffusion model. For example, Labay & Kinnear (1981) tested the predictability of the five attributes against the predictability of adoption from a model using standard demographic variables on the innovation of solar water heaters. The authors found that the innovation attributes were better at predicting adoption, although the two models (diffusion and socio-demographic) predicted similar results for non-adopters. The five attributes of an innovation may be influential, particularly with certain innovations, but there may be other variables which do not necessarily fall into these categories and are also important for the diffusion of innovations. Innovations have received very little attention in diffusion studies (1% of studies, Rogers 2003), so it also may be that more research is needed to more fully understand the validity of the five innovation attributes.

3.3.2 Time

The diffusion of innovations is a process. The rate of adoption takes place over time, and is measured by the percentage of people in a system that adopt the innovation. This is often displayed as a sigmoid, or S-curve, as per Figure 3-1, which demonstrates cumulative adoption, over time, of an innovation.

Figure 3-1: S-curve of adoption over time



Different people may adopt innovations at different times, and are thus grouped into five categories, according to Rogers (2003):

- Innovators – the very first to adopt an innovation
- Early adopters – those next to adopt, who are more visible
- Early majority – the first swing of critical mass
- Late majority – those who are at the tail end of the critical mass, and
- Laggards – the very last to adopt an innovation.

Measurement of adopter categories, as per Valente (1996), is as follows: innovators[38] and early adopters are those that adopt more than one standard deviation before the average time of adoption; the early and late majority fall within one standard deviation before and after the average time of adoption; and laggards or more than one standard deviation above the average. The time period over which these are measured must be determined by the researcher.

There is evidence to suggest that energy efficiency policy should be targeted to the appropriate adopter category for maximum efficiency. According to the research of Egmond et al. (2006), 'early market actors' (essentially innovators and early adopters) have different motivations than the mainstream market actors (i.e. early majority, late majority, laggards) who tend to seek functionality, avoid risk and "stay with the herd" (Egmond et al. 2006, p.4044). One implication is that those trying to promote energy efficiency innovations, such as policy makers, cannot use the same tactics for all members of a society or even community due to timing and personal attributes of the adopters.

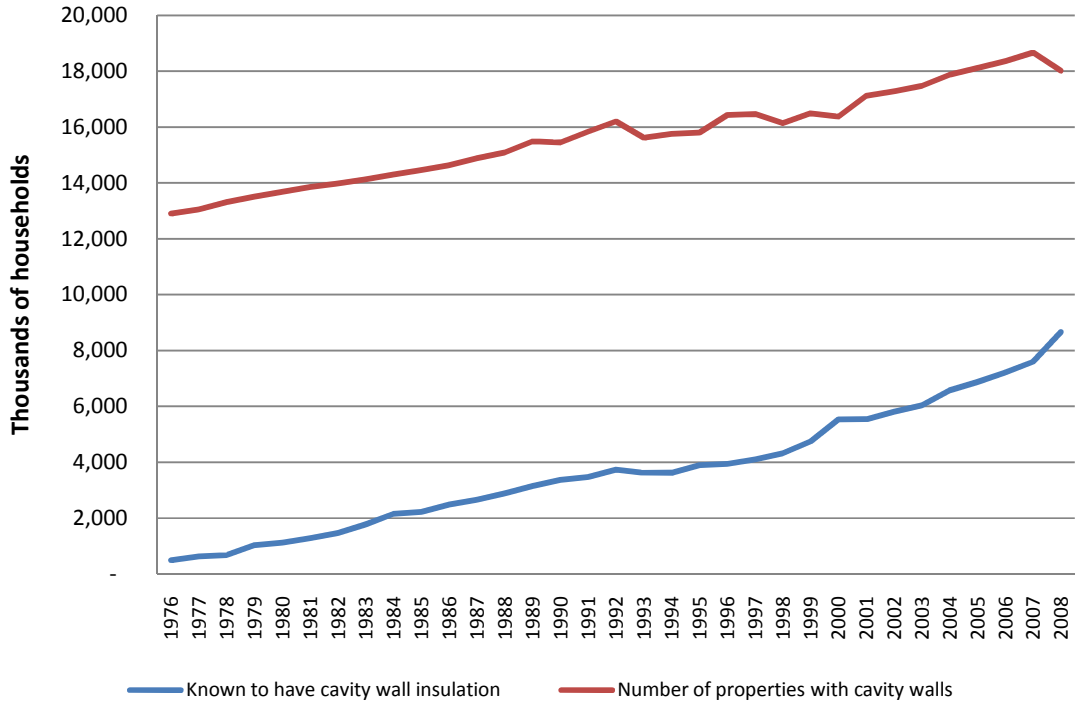
While there are several studies which examine all, or a selection of, the adopter categories with relevance to household-level *renewable energy* innovations (Farhar & Coburn 2000; Arkesteijn & Oerlemans 2005; Faiers & Neame 2006; Mahapatra & Gustavsson 2008), there are very few examples charting adoption of *energy efficiency* or *energy conservation* measures over time amongst householders. In order to understand the trends of energy-reducing technologies in the UK, Figure 3-1, Figure 3-2, Figure 3-3, and Figure 3-4 present findings summarised by DECC (2010a). These

[38] Valente (1996) explains that the category of 'innovator' was only added to this classification by Rogers in 1993. For measurement purposes, the percentage of innovators is so small that he collapsed the measurement of the category with early adopters.

do not directly identify adopters by stage, but give an overview of the state of the specific technology diffusion rates.

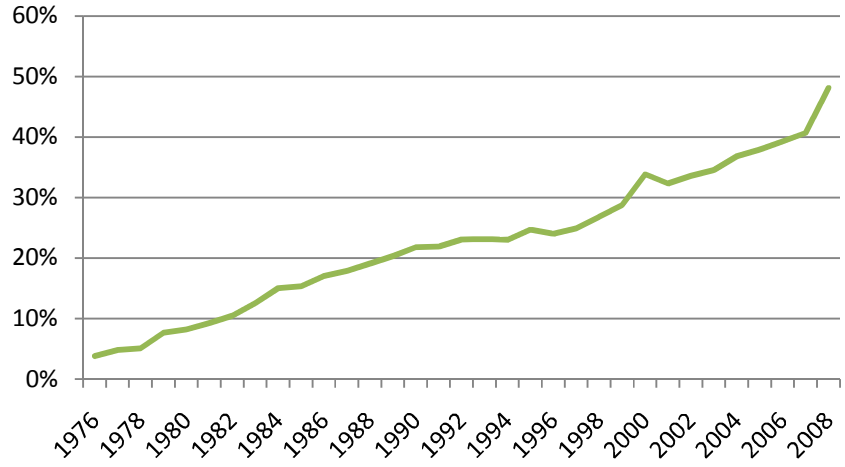
In the *UK's Energy Efficiency Plan 2007* (Defra 2007a), the Government indicates the technical innovations that are the most commonly promoted for reducing energy use are: insulation (wall and loft), low energy lighting, highly efficient appliances and heating systems, and draught-proofing (Defra 2007a, p.28). The first three – cavity wall insulation, loft insulation and low energy lighting – are examined here, as these data are clearly available from the Government (DECC 2010b).

Figure 3-2: Ownership of cavity wall insulation, 1976-2008: properties suitable & properties known to have installed (derived from DECC 2010b, Table 3.15b)



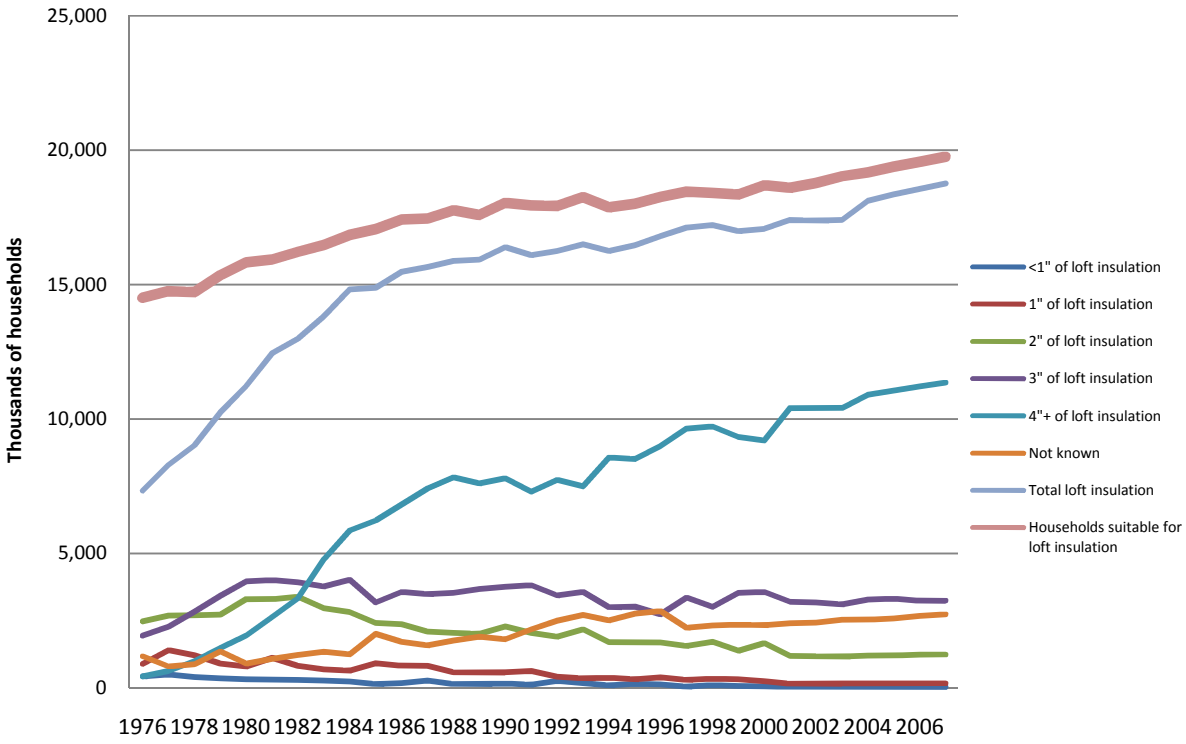
As of 2008, approximately 18,000 properties (Figure 3-2), or just over 48% of homes that were suitable for cavity wall insulation actually had it installed (DECC 2010b). This was the result of an upward trend (Figure 3-3). The Government hope to increase this to 100% by 2015 (DCLG & DECC 2010). Reaching 100% installation by 2015 would involve an extremely rapid rise in the percentage of homes with cavity wall insulation.

Figure 3-3: Percentage of suitable properties with cavity wall insulation, 1976-2008 (derived from DECC 2010b, Table 3.15b)



Loft insulation involves laying down a layer or multiple layers of insulation in the loft, or attic, of a home or block of flats. This means that there are several different depths of insulation. The UK building regulations recommend 250 millimetres (just under 10 inches) of mineral or cellulose fibre insulation for optimum insulating properties in existing buildings (HM Government 2010).[39] Figure 3-4 charts the number of homes with different levels of insulation.

Figure 3-4: Ownership of loft insulation, 1976-2009 (derived from DECC 2010b, Table 3.15a)



In the case of loft insulation, a total of around 95% of houses have some type of insulation (DECC 2010b). However, only 57% of suitable houses are insulated to 4 inches or above. It thus appears that the target will focus on topping up insulation to the approximate 10 inches recommended to achieve its target of 100% loft insulation installed by 2015 (DCLG & DECC 2010).[40]

[39] In new buildings, 270 mm of insulation are recommended.
[40] The *Warm Homes, Greener Homes* document (DCLG & DECC 2010) does not indicate how much insulation needs to be installed in 100% of houses by 2015, so this estimate is simply based on the Building Regulations (HM Government 2010).

Figure 3-5 indicates the number of types of lighting owned in UK households (DECC 2010b). The EU has issued a directive which phases out the marketing and distribution by companies of incandescent light bulbs (EC 2009). By 2011, for example, 60-watt incandescent bulbs will not be allowed to be marketed. It would thus be expected that the number of low-energy lights will rise very rapidly in the coming years through this market transformation measure.

Figure 3-5: Number of types of lighting in households, 1970-2009 (derived from DECC 2010b, Table 3.11)

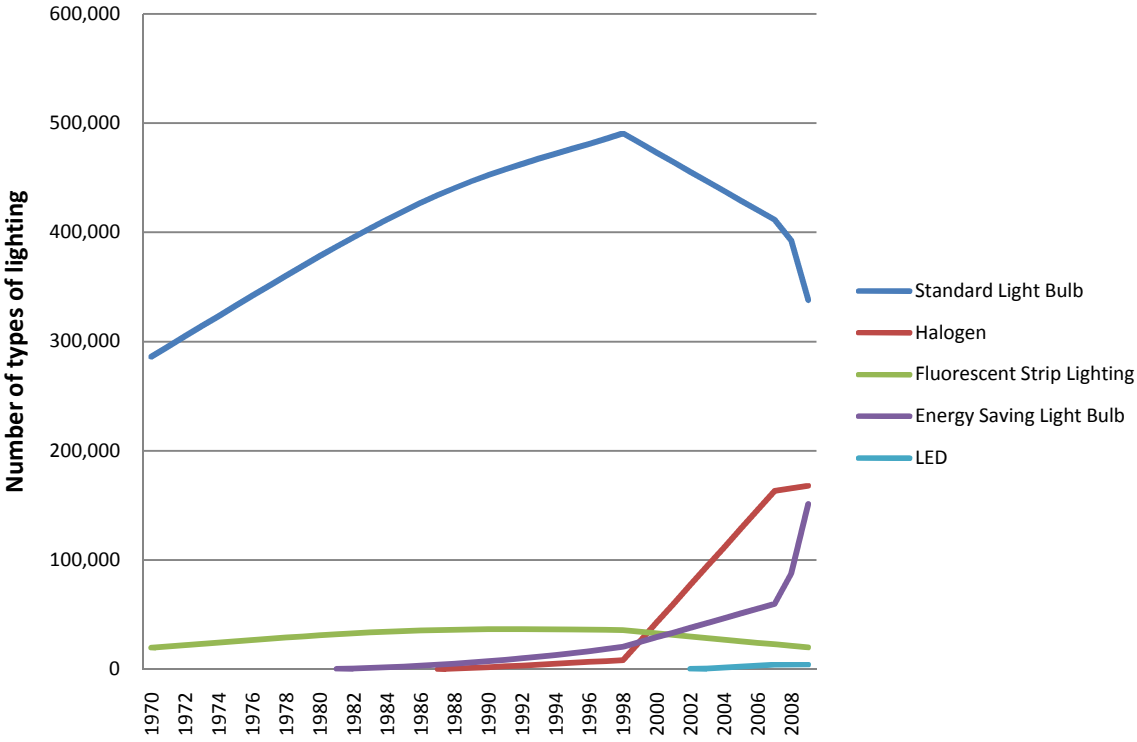


Figure 3-2, Figure 3-4 and Figure 3-5 suggest that the innovators and early adopters, at the very least, have adopted loft and cavity wall insulation and low energy lighting. In order to meet policy expectations, cavity wall insulation, in particular, will need to experience a rapid rise in diffusion, with the later adopters (maybe the early majority, and certainly the late majority and the laggards) installing insulation within the next four years.

3.3.3 Social system

Another element of the diffusion of innovations is the social system, which "constitutes a boundary within which an innovation diffuses" (Rogers 2003, p.24). Constituents of a social system include the social structure, social norms and interpersonal networks. The social structure is the set of "patterned social relationships" (Rogers 2003, p.24)

which enables communication structures and is composed of differentiated and distributed roles and statuses (Katz et al. 1963). Norms are "the established behavior patterns for the members of a social system" (Rogers 2003, p.26) and an assumed prior condition that enable, or constrain, adopting units to act (Wilson & Dowlabatadi 2007). As Rogers (2003) indicates, "it is a rather complicated matter to untangle the effects of a system's structure on diffusion, independent from the effects of the characteristics of individuals that make up the system" (p.25), which he further indicates may contribute to the relatively few studies on social structures, and by association, social systems.[41]

Though there do not appear to be many studies which focus on the social system in diffusion theory with regard to energy-reducing innovations, there are many which look at norms and interpersonal networks, the latter of which is discussed in the next section (3.3.4). Midden & Ritsema (1983) indicate that the social norms of energy conservation involve normative influence and social sanctions. In order for a person to be susceptible to normative influence and control, the person must feel like they are a part of some group or social system. "The more cohesive the social system, the more uniform the attitudes and behavior of the members" (Midden & Ritsema, p.41). Though even with high degrees of cohesion and high levels of interaction, there is still a need to make the social norms of energy use visible (Stern 2002). If the Government, for example, is attempting to both influence social norms of household energy use and make them visible, they could do this through social comparison, i.e. the process through which "social norms become personal norms" (Fell et al. 2009, p.20) or through the use of change agents and opinion leaders. A change agent "is an individual who influences clients' innovation-decisions in a direction deemed desirable by a change agency" (Rogers 2003, p.366) while an opinion leader is generally someone embedded in a social system (e.g. a householder in a given geographic neighbourhood) who is able to exert influence over other members of the social system. Weenig (1993) conducted a community-based energy efficiency experiment in The Netherlands in which two change agents trained local opinion leaders (who were called 'paraprofessionals'). The paraprofessionals were chosen by the authors from a group of volunteers based on how many other people the volunteers knew within the local area. Weenig (1993) confirmed her hypothesis that "a direct tie between a respondent and the paraprofessionals was a significant predictor for awareness of the program overall, for awareness of its specific activities, and for attention to program activities" (p.1728). Similarly, literature on intermediaries (a term that parallels

[41] Rogers (2003) indicates that only 2% of diffusion studies use social systems as the unit of analysis.

'paraprofessionals') suggests that those groups of people who sit between energy companies and householders, for example, are uniquely placed to encourage the flow of information (Moss et al. 2009; Backhaus 2010). "Intermediaries are organizations, individuals, and members of professional reference groups who stand somewhere between the originators of energy-related goods, services, and information and the ultimate energy users" (Stern & Aronson (eds) 1984, p.117). The particular advantage of an intermediary is the ability to act as a mediator between stakeholders, maintain a flexible structure, utilise established links or connections with end-users, build trust, and "support and facilitate learning processes" (Backhaus 2010, p.88). The literature on intermediaries often refers to organisations which sit between energy providers, energy users, and energy regulators (Backhaus 2010), but they could also be community groups which are embedded in the target population. Stern (2002) recommends the use of community groups as intermediaries, as they might aid home energy use information dissemination, but further emphasises that "these groups are not simply channels for transmitting messages. They are most effective when they adopt the intervention as their own, perhaps adapting the message in the process to make it meaningful to their constituencies" (p.205).

3.3.4 Communication networks

Social systems are the foundation for communication channels, the final element for discussion in the theory of innovation diffusion. These channels of communication can occur interpersonally through existing social networks and non-interpersonally through written or televised media, for example. The UK Government has largely focused on communicating messages of energy efficiency through websites, such as *Act on CO_2*,[42] and through other efforts of the Energy Saving Trust (Wallace et al. 2010). The Energy Saving Trust promotes household energy efficiency through websites and through local energy efficiency advice centres. The obligation on UK energy companies to encourage customers to reduce energy also means that messages are reaching customers through their energy suppliers, either in personal written communication or through mass media campaigns. However, there is a fear that these messages may not be deemed trustworthy, as several studies have found (Coltrane et al. 1986). Stern & Aronson (eds., 1984) suggest several ways which may help utilities overcome this, by:

> "creating partnerships between low- and high-credibility sources (for example, by making the resources and skills of utility companies available to non-profit community groups), utilizing grassroots organisations and pre-existing neighbourhood groups, creating new organizations that would not be marred by

[42] Act on CO_2, http://actonco2.direct.gov.uk/home.html

> conflicts of interest and by stricter regulation of new and existing providers of information and services" (Coltrane et al 1986, p.139).

Whilst general media messages can be effective, particularly amongst those who tend to be the innovators or early adopters (Darley & Beniger 1981), there is evidence to suggest that these messages are more effective when they are verified through social networks (Ball et al. 1999). Coltrane et al. (1986) indicate that social diffusion recognises:

> "that the process of new technology adoption tends to occur through existing social networks and that most people adopt innovations only after their effectiveness has been demonstrated through the experience of friends and acquaintances" (p.142).

Regarding existing social networks and the diffusion of innovations, there are several aspects which have been examined in order to understand the effectiveness of certain social contacts and social networks, including the number of people a person speaks to (Weenig & Midden 1991; Abrahamson & Rosenkopf 1997), the content issues such as strength of interpersonal "ties"[43] (Granovetter 1973; Weenig & Midden 1991), and geographic location (Rogers 2003; Wellman 1979; Wellman 2001). These elements of social networks are also integral to social capital, which is defined as "access to and use of social resources embedded in social networks" (Lin 1999, p.30). The communication channels of social networks and social capital are discussed in greater detail in Chapter 4.

3.4 The innovation-decision process

In order to understand social networks and social capital, which are examined more at the social structural-level, it is important to review the more psychological elements of diffusion theory. Messages of innovations, such as energy efficiency and conservation, are spread through communication channels of a social system over time. Adoption (or non-adoption) occurs at some point in that process. But when and how do adopting units, i.e. people, actually make the decisions as to what they will do? The innovation-decision process attempts to answer this question. As Rogers (2003) indicates:

> "the innovation-decision process is essentially an information-seeking and information-processing activity in which an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation" (p.172).

This process is envisaged in five stages, which, according to Rogers (2003), consists of: knowledge of an innovation; persuasion toward using it; the decision to adopt or reject; implementation and use; and confirmation of the decision. Each of these five stages is examined here.

[43] A tie is the social connection between two people.

3.4.1 Knowledge

Knowledge of an innovation involves initial *awareness* and eventual *understanding* of an innovation. An adoption unit, i.e. a person or group, must first know that an innovation – be it a technology, idea or practice – exists in the world before it can be considered any further. This involves receiving messages about an innovation and being able to recall the messages, and a basic understanding of the innovation.[44] It is generally posited that it is lack of knowledge and awareness which is partially responsible for a lack of adoption of energy efficiency measures (Stern 2006; Defra 2007a). According to the National Audit Office's review of energy efficiency policy and research, "50 per cent of householders cite a lack of understanding of their energy consumption – and the corresponding costs and potential savings – as a reason for not taking action" (NAO 2008, p.36).[45] Weenig (1993) measured awareness of a targeted energy efficiency intervention in a Dutch experiment in two neighbourhoods of Maastricht. The 'paraprofessionals' mentioned in section 3.3.3 were trained to communicate messages about heating controls and energy reducing behaviour surrounding heating and ventilation systems in the experimental neighbourhood. A series of surveys asked respondents three questions relating to awareness: overall awareness of the programme; awareness of specific programme interventions which could be recalled by the respondent (unaided by the interviewer); and attention to the interventions (i.e. leaflets), which included information about attending local meetings and having a home energy check performed. The results of a post-test indicated that 75% were aware of programme activities, and were able to recall an average of 1.8 activities, and 60% had paid attention to the leaflets or other activities. It was concluded that this was quite an accomplishment, as: "Awareness figures of such campaigns for the entire Dutch population have seldom reached beyond 40%, and attention seldom exceeded the 10% limit" (Weenig 1993, p.1730). The author attributes the awareness to the social network influences of the trained volunteers who were neighbours, friends or community members to the respondents.

3.4.2 Persuasion

The persuasion stage is "when an individual (or other decision-making unit) forms a favorable or an unfavorable attitude towards the innovation" (p.169). It is at this point that a person makes "affective (or feeling)" judgement (Rogers 2003, p.175) about the innovation, as per the five attributes discussed in 3.3.1. Rogers (2003) indicates that it

[44] Rogers (2003) identifies two other types of this *understanding* knowledge, which he calls 'how-to knowledge', i.e. understanding how the innovation generally works, and 'principles knowledge', which involves understanding the underlying functioning of the innovation.
[45] It is unclear how exactly this was measured and if the original data made the direct link between information and action.

is at this phase when a person will start to seek advice from others, or make judgements based on, for example, media campaigns. In the case of household cavity wall insulation, a householder may notice advertisements or hear comments made by neighbours about insulation, and then start conversations or look on the internet to find out more. It is at this stage that a person evaluates the credibility and trustworthiness of advice, and decides how to interpret the information they receive (Rogers 2003). In reviewing the diffusion of energy efficiency, Darley & Beniger (1981) conclude that:

> "we are more persuaded by an individual who does not stand to gain if he persuades us, and ... seems to be most effective when it is between individuals than when it is between an individual and an audience" (p.342).

Similarly, Weenig (1993) felt that the "quality or strength of ties", i.e. the type of relationship between the potential adopter and the person from whom they receive information on the innovation, is an indicator of potential for normative influence and persuasion (p.1712-1713). She found that strong ties, i.e. family and friends, were influential in persuading the potential adopters to adopt energy efficiency.

3.4.3 Decision

The decision stage is "when an individual (or other decision-making unit) engages in activities that lead to a choice to adopt or reject the innovation" (Rogers 2003, p.169). At this point, it is still a "mental exercise of thinking and deciding" (Rogers 2003, p.179), but an intention is formed. A decision generally indicates that an individual either has full or partial intention of proceeding to the next implementation stage at some point in the future, or does not intend to consider it and will take no further action. There are two types of rejection, as Rogers (2003) indicates: active rejection and passive rejection. Active rejection means a person considered the innovation but decided against it. For example, a householder may consider cavity wall insulation, but discount it due to cost. Passive rejection means the person never really considered the innovation seriously. For example, a householder may have a brochure of a cavity wall installer on their desk with the intention of getting more information and making a decision, but never actually make any further enquiries.

In a study of householders in Christchurch, New Zealand, Ball et al. (1999) investigated awareness, consideration and adoption of compact fluorescent lights (CFLs) and hot water cylinder (HWC) insulation. They found that 25% of respondents had considered adopting CFLs and 38% had considered HCWs, but adoption was less than 10% in both cases. They concluded that:

> "At the adoption stage the number and nature of the information sources were a distinguishing feature between adopters and rejecters ...The implication ... is that

> mass media campaigns or price subsidies may increase awareness but they may not increase adoption rates. To increase the adoption rate among those who reached the decision stage, greater inter-personal communication is required" (p.130).

This confirms Rogers' (2003) indication that communication, including interpersonal communication, is necessary for progressing through the innovation-decision process.

3.4.4 Implementation

The implementation phase "occurs when an individual (or other decision-making unit) puts an innovation to use" (Rogers 2003, p.179). Rogers indicates that active information-seeking occurs at this phase for the practical elements of adoption. Further, "implementation involves overt behavior change as the new idea is actually put into practice" (Rogers 2003, p.179). In the example of cavity wall insulation, this is the point of time when a householder would, for example, contact their energy supplier, enquire about rebates and discounts, choose an installer, contact that installer, and arrange the time and date for the cavity wall insulation to be installed. In reality, this can take quite a while. There is also the possibility that the householder will not complete the process, or that external forces, e.g. an unreliable contractor, will make it so difficult that the householder feels he or she cannot proceed. If the process is undertaken and the contractor installs the insulation satisfactorily, the person has thus implemented and adopted the innovation. In the case of cavity wall insulation, the point between deciding to install and having the work completed may take days, weeks, months or longer. Rogers (2003) admits that the implementation phase "may continue for a lengthy period of time" (p.180), however he appears to refer more to the actual implementation, rather than the process leading up to implementation.

Rogers (2003) claims that for some innovations, implementation is the end of the innovation-decision process. The example of cavity wall insulation applies here. Once it is installed, there is usually no need to 'confirm' the decision (see next section) because uninstalling it is difficult (Howell 2010). But for low-energy lights, the implementation stage would continue until "the innovation loses its distinctive quality as the separate identity of the new idea disappears" (Rogers 2003, p.180). Afterwards, it is generally necessary for a confirmation to take place.

3.4.5 Confirmation

The confirmation stage is when the adopter seeks "reinforcement of an innovation-decision already made" (Rogers 2003, p.169), but the decision can be reversed at any time if the person is unsatisfied or is "exposed to conflicting messages about the

innovation" (Rogers 2003, p.169). Rogers (2003) adds this phase as he indicates there is empirical evidence to suggest that adopters continue to seek information after they have adopted an innovation, which can either confirm attitudes and beliefs, or conversely reverse the decision. Reversing the decision is called 'discontinuance' by Rogers (2003). In the case example of low-energy lighting, it may be that a person is not content with the new bulbs, perhaps because of the quality of light or length of time it takes to reach its full lumens. They discontinue the adoption if they replace it with the original incandescent bulb. This would constitute rejection, rather than full confirmation, of the new bulb. Conversely, reinforcement may assist in continued confirmations. This was the finding in Pallack et al.'s (1980) study where a group of householders made a public commitment to saving energy, confirmed their decision by making a commitment, and further confirmed this 12 months later when they were still saving more electricity than a control group.

3.4.6 Other considerations in the innovation-decision process

Rogers (2003) recognises that the order does not always occur chronologically; awareness, persuasion, decision, implementation, and confirmation do not always occur in this order. However, though Rogers (2003) admits that measurement of stages presents empirical difficulties in confirming this or any other order in the process, he only really mentions one alternative order: decision may precede persuasion in some cases. Though it is difficult to confirm, it is possible to conceive of other possibilities, e.g. implementation precedes persuasion, and further research would be needed to understand this cognitive process.

It is also worth noting that the model does not discuss the degree to which each stage needs to be fulfilled. For example, with energy efficiency innovations, the level of knowledge obtained at the 'decision' stage may be substantially lower than the innovation-decision process assumes. This is due to a high degree of complexity in some technologies, such as smart meters (Darby 2010), and also the lack of knowledge of underlying physical processes. If a person does not have this 'complete' knowledge, they may have to strictly rely on the examples and recommendations of others to allay fears and uncertainties. Again, this is a question for which empirical research would be needed.

A final consideration in the innovation-decision process is that of 're-invention', or "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation" (Rogers 2003, p.180) which Rogers (2003) claims usually occurs in the implementation phase. Adopters may modify how they use an

innovation, based on perceived complexity or lack of a designer's knowledge of how it is to 'meant' be used. For example, a household heating thermostat is generally 'meant' to be used a certain way, at a recommended temperature and with accompanying timers, if present. But they may be 're-invented' as clothes driers (i.e. turning up a thermostat to dry laundered clothes) or building maintenance devices (i.e. turning up a thermostat to prevent damp in walls). Timers may be ignored. And thermostats could be used as simple on/off switches for the heating, instead of leaving them at a constant temperature. These anecdotal examples, and many other empirical examples which Rogers (2003) discusses (p.182-183), highlight the necessity for researchers to not assume that an innovation-decision process leads to a preconceived notion of adoption.

3.5 Critiques and conclusion

As briefly discussed in Chapter 2, the diffusion of innovation theory has attracted criticism from social researchers of household energy consumption. In particular, the theory has been criticised for its assumption of linearity in decision processes, as discussed above, and the reliance on awareness and attitudes (Faiers et al. 2007) which lead to preconceived outcomes (Wilson & Dowlatabadi 2007). It has also been critiqued for "not consider[ing] the consumers' rationale with respect to the characteristics of the items under consideration" and instead focusing on "information-related technology dissemination such as word of mouth" (Dyner & Franco 2004, p.380). It could also be that the rational of decision-making is not simply based on what is often assumed to be objective information achieved in the communication process. As Jorde-Bloom (1986) found, "subjectively, individuals also relied on their intuitions and emotional reactions to the changes they perceived would result from adopting the technology" (p.194). These rather 'subjective' elements are rather marginalised in the discussions surrounding adoption decisions. It is conceivable that a potential adopter of a smart meter or insulation will immediately jump from initial knowledge to confirmation of the decision, just based on a 'gut feeling'. Accordingly, there are proposals that the information-decision process should actually be reconfigured to put familiarity and interest in the innovation at the centre of the process, rather than information (Kaplan 1999). There are also further suggestions that Rogers (2003) innovation-decision process misses other steps in the cognitive process between knowledge and confirmation, such as a "tentative adoption" (Jorde-Bloom 1986, p.195).

Accepting these limitations to diffusion theory, if approached within a wider socio-technical framework, which accepts that processes are not always linear, may include other steps or modifications, and outcomes are not always predetermined, diffusion

theory provides a useful tool for understanding the relationship between the communication of information as related to the process of specific technology and behavioural changes. The focus on communication and adoption rates of energy-reducing innovations proposed here is specific, but it is not meant to neglect the social norms, cultural context, daily practices, economic realities and evolution of technologies embodied in a socio-technical approach to household energy use. Further, as described in this chapter, the diffusion of innovations theory has provided a model for studying and describing aspects of innovations (Darley & Beniger 1981; Ball et al. 1999; Menanteau & Lefebvre 2000; Vollink et al. 2002), provided a useful understanding for examining the diffusion of insulation and lighting within the UK, and provides a systematic framework for consideration of communication networks (Ball et al. 1999; Weenig & Midden 1991).

Though diffusion theory claims that the 'social system' is one of the tenets of the theory, there is very little research attention given to social structures, as Rogers (2003) admits (p.25). This is where diffusion theory appears to be particularly limited, in that focusing on the specifics of innovations may neglect the wider political influences, cultural situations and economic circumstances of adopters. However, the focus on communication networks yields an opportunity to incorporate at least parts of the wider social structure and social system. Though only briefly discussed in section 3.3.4, communication networks utilise existing social structural arrangements to spread messages about innovations, which potential adopters (or non-adopters) either notice and follow-up on, or ignore. When innovations are new or not fully understood, there is a need to reduce uncertainty by seeking information (Dearing 2008). The theory of social capital, as examined in the next chapter, is a parallel approach for examining information-seeking on innovations.

Chapter 4: SOCIAL CAPITAL

4.1 Introduction

Empirical evidence from the Netherlands and New Zealand, in particular, has demonstrated the importance of social networks for the diffusion of innovations (Weenig & Midden 1991; Weenig 1993; Ball et al. 1999). The theory of social capital, which is here defined as the "resources embedded in a social structure which are accessed and/or mobilized in purposive actions" (Lin 1999, p.35), appears to be a constructive perspective to examine the diffusion of innovations. With its emphasis on the resources available in social networks, it is a complementary theoretical perspective to the communication networks of the diffusion of innovations.

Several definitions for social capital have been proposed in the past thirty years. The definition used here belongs to what is sometimes referred to as social 'network capital' (Fafchamps & Minten 2002; Wellman 2007), the 'network approach' to social capital (Burt 2000; Moore et al. 2005) and 'individual social capital' (van der Gaag & Snijders 2004a; Yang 2007; van der Gaag & Webber 2008). 'Individual social capital' regards the individual as the person who invests in social networks with benefits received to that person. There is another branch of social capital definitions which is more likely to view a group or social system as the beneficiary of collective individual actions. This latter branch has been referred to as the 'communitarian' approach to social capital (Woolcock & Narayan 2000; Moore et al. 2005) and 'collective level social capital' (van der Gaag & Webber 2008). Most definitions, regardless of the unit of analysis, are based on the social connections between people, i.e. social networks. The two branches – here called 'collective social capital' and 'individual social capital' (Kadushin 2004b; van der Gaag & Webber 2008) – are based on social networks, but differ not only in the level to which they apply, but also in the theoretical assumptions, which has implications for measurement instruments and research methods. The 'collective level' is much more popular, but the concepts that arise from the 'individual level' branch provide better grounding in general 'capital' theory and provide clearer opportunities for measurement.

This chapter begins by reviewing the history of the term and concept of social capital, focusing particularly on the key authors who developed the common usages of the theory. The next section briefly outlines 'collective social capital,' in order to indicate why the focus here is on 'individual social capital,' which then receives more attention. An account is given of the dimensions and associated methods of measurement of

'individual social capital,' which is then contrasted with the dominant 'collective level' version.

4.2 History of social capital

Though the tenets of social capital have been recognised for hundreds of years (Portes 1998, Adam & Rončević 2003),[46] Lyda J. Hanifan is most often credited as the first person to have published research using the term 'social capital' in 1916 (Putnam 2000; Woolcock & Narayan 2000), stating that it is "…good-will, fellowship, mutual sympathy and social intercourse among a group of individuals and families who make up a social unit…" (Hanifan 1916, p.130). Hanifan (1916) further indicates that it is contact with not only family members, but neighbours and others, which causes the accumulation of social capital, and which thus improves the whole community. Hanifan's "social capital" focus in his 1916 and subsequent publications emerged from the 'social center movement' which "placed education in general—and the school in particular—at the center of public life" (Farr 2004, p.12).[47] Hanifan used the term to conceptually link ideas that had until that point not been commonly regarded as important for community, such as "good roads and community surveys" (Farr 2004, p.13). Using the term *capital* with *social* also sought to highlight the accrued benefits that could be gained through community life and support, though he only meant 'capital' in a figurative sense (Farr 2004).

In their review of social capital development, Woolcock & Narayan (2000) note that the term was "reinvented in the 1950s by a team of Canadian urban sociologists (Seely, Sim, and Loosely 1956), in the 1960s by an exchange theorist (Homans 1961) and an urban scholar (Jacobs 1961), and in the 1970s by an economist (Loury 1977)", none of whom referenced any others, but all were deemed to have "used the same umbrella term to encapsulate the vitality and significance of community ties" (Woolcock & Narayan 2000, p.229).

Despite the few authors who discussed social capital from the 1950s to the 1970s, social capital was only popularised in the 1980s and 1990s through the influence of a number of social scientists, notably Pierre Bourdieu, James Coleman and Robert

[46] Portes (1998) highlights the related concepts in the works of Emile Durkheim (i.e. "group life as an antidote to anomie and self-destruction") and Karl Marx (who distinguished between "class-in-itself and a mobilized and effective class-for-itself"), and indicates that "the term social capital simply recaptures an insight present since the very beginnings of the discipline" of sociology (p.2). The ideas are also connected with "thinkers such as Tocqueville, J.S. Mill, Toennies, Weber and Simmel" (Adam & Rončević 2003, p.156).

[47] Farr (2004) indicates that Hanifan's ideas and work were based on the 'new civicness' ideas of John Dewey, an author whom Farr (2004) traces as having used the term social capital in "four different publications (1900, 1909, 1915, and 1934), three of which preceded Hanifan's usage" (p.17). It appears that Dewey's and Hanifan's ideas were of a similar meaning, largely borne of the 'social center movement.'

Putnam. Others have contributed simultaneously and since, but as these three authors have contributed most significantly to the development of social capital theory (Foley & Edwards 1999; Field 2003; Adam & Rončević 2004; Yang 2007), they are discussed in more detail.

4.2.1 Bourdieu, Coleman & Putnam

In his review of the origins of social capital, Portes (1998) indicates that "the first systematic contemporary analysis of social capital was produced by Pierre Bourdieu," particularly in a 1980 publication (Portes 1998, p.3). But it was not popularised in the English-speaking world for some time afterwards, and the definition most often quoted, from a 1986[48] text, was "concealed" in a dialogue on the sociology of education (Portes 1998, p.3). Bourdieu's (1986) definition of social capital is:

> "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalised relationships of mutual acquaintance and recognition – or, in other words, to membership in a group – which provides each of its members with the backing of the collectively-owned capital, a 'credential' which entitles them to credit, in the various senses of the word" (p.248).

Bourdieu explained that an individual ('habitus') is part of a social 'field', or network, and is structured by that social world, whilst also dynamically interacting with it (Grenfell 2004). Social capital, according to Bourdieu, involves an individual accruing benefits by being involved in, and constructing, the social world, and drawing upon those benefits and resources (Portes 1998), which are maintained through mutual recognition and created through multiple interactions of individuals in social groups (Lin 2001b). Bourdieu also emphasises the presence and fungibility (i.e. interchangebility) of social capital with economic capital and cultural capital.[49] Economic capital is the more recognised form of capital which largely involves "accumulated human labor" (Portes 1998, p.4). Cultural capital consists of social prestige, gained through knowledge, education and skills.[50] Cultural and social capital, in particular, are means to greater economic capital; they "possess their own dynamics, and, relative to economic exchange, they are characterized by less transparency and more uncertainty" (Portes 1998, p.4).

[48] Portes (1998) actually says it was a 1985 text, but the reference refers to a publication that is most often credited as having been published in 1986.
[49] Bourdieu adheres to particular aspects of the theories of Karl Marx (Foley & Edwards 1999), principally in his belief that most of these types of capital rest in the hands of the dominant social classes (Lin 2001b).
[50] Bourdieu approached 'culture' in two distinct ways: "as language, traditions, characteristics and beliefs" and also has what might be called high culture: "aesthetics – art, music and literature" (Grenfell 2004, p.89).

James Coleman (1990) defined social capital as:

> "a variety of different entities having two characteristics in common: They all consist of some aspect of a social structure, and they facilitate certain actions of individuals who are within the structure" (p.302).

Coleman claims social capital is productive, like other forms of capital. His definition focuses on social embeddedness: "social capital inheres in the structure of relations between persons and among persons. It is lodged neither in individuals nor in physical implements of production" (p.302). As Portes (1998) points out, his analysis is based on individuals or small groups, similar to Bourdieu, with benefits bestowed on the individual. "The function identified by the concept 'social capital' is the value of those aspects of social structure to actors, as resources that can be used by the actors to realize their interests" (Coleman 1990, p.305). Coleman's approach defines social capital by its function (Sandefur & Laumann 1998). Barbieri (2003) states that Coleman's definition emphasises the specificity of use, and the "emphasis on conscious, individual, rationally oriented motivation of using social capital for purposive actions" (p.684). Coleman's definition has been critiqued as being unspecific (Portes 1998; Lin & Erickson 2008), particularly in terms of the sources of social capital, but has provided a basis for explaining the benefits secured "by virtue of membership in social networks or other social structures" (Portes 1998, p.6).

In contrast to Bourdieu and Coleman, Robert Putnam (2000) emphasises broader benefits, stating that: "social capital refers to connections among individuals – social networks and the norms of reciprocity and trustworthiness that arise from them" (p.19). Putnam (2000) suggests that social capital is simultaneously both a private and public good. The benefits are not just accrued at the individual level, but also form a collective 'good' from which all people in a social system can benefit. Putnam distinguishes different types of social capital, namely bonding and bridging social capital. Bonding social capital is exclusive, existing in close relationships, particularly between family members. Putnam (2000) indicates that other "examples of bonding capital include ethnic fraternal organisations, church-based women's reading groups, and fashionable country clubs" (p.22). Bridging capital extends to larger social networks, such as "civil rights movement, many youth service groups, and ecumenical religious organisations" (Putnam 2000, p.22), is inclusive and useful for information diffusion.

Putnam, a political scientist, has been particularly influential in popularising the term social capital in recent years (Adam & Rončević 2004), particularly through his 2000 publication, *Bowling alone: The collapse and revival of American community*, drawing the title from the rising number of Americans who bowl alone rather than in group

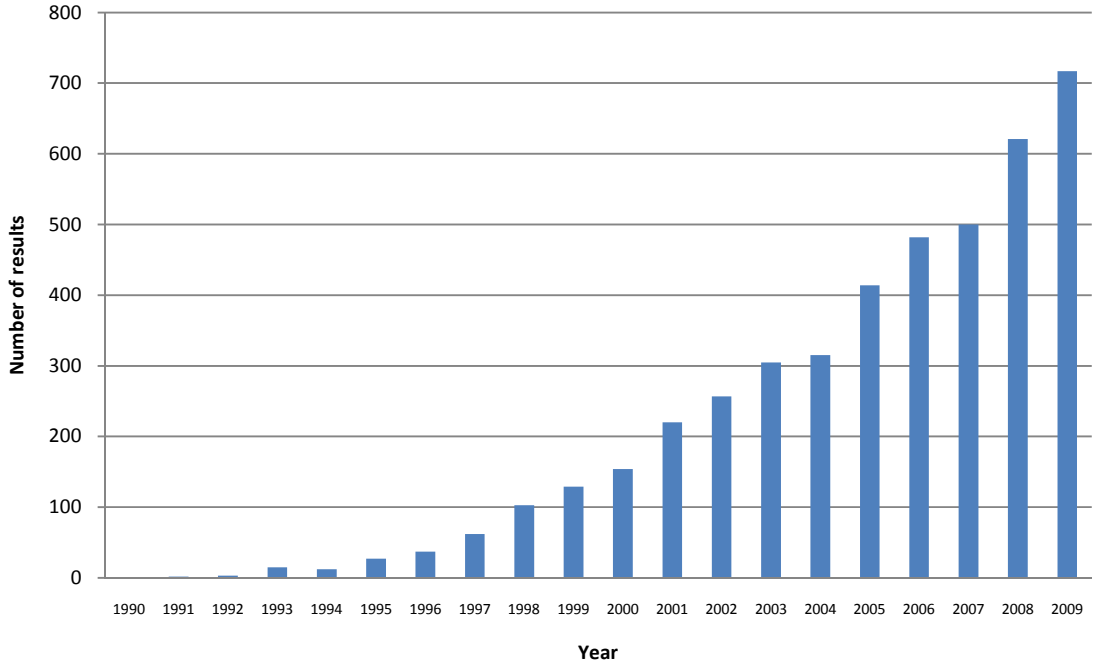
leagues. However, “most authors agree with Coleman’s formulation that we are dealing with certain aspects of social structure that enable social action” (Adam & Rončević 2004, p.187; see also Foley & Edwards 1999). Putnam himself credits Coleman with putting “the term firmly and finally on the intellectual agenda in the late 1980s” (Putnam 2000, p.20). The differences between Putnam and Coleman, as well as Bourdieu, lie largely in the sources and consequences, i.e. benefits, of social capital. Bourdieu views social capital as something which individuals can access from social networks, aided by economic and cultural capital, and accumulate on an individual level. More social capital is better, something “that can be cashed in terms of social mobility” (Silva & Edwards 2004, p.3). Coleman’s view is similar in that the social structure is the source of social capital and benefits are accrued on the individual level. However, according to Coleman (1990), the sources of social capital exist between individuals (i.e. not necessarily *in* individuals), and the benefits focus less on the social class conflicts and more on “productive capacity [which] extends beyond economic returns to any outcome of interest to a goal-directed actor” (Sandefur & Laumann 1998, p.485). Coleman also indicates that social networks can facilitate social norms and trust (Adler & Kwon 2002). Putnam’s approach is similar in this respect to norms and trust, but diverges in his accreditation of sources originating from group memberships or other forms of social interaction, claiming that benefits are felt not only by the individual, but also by the social system.

4.2.2 More recent developments

In the 1990s, and particularly in the early 2000s, much more attention was given to social capital by academics and policy-makers, as demonstrated through the increase in publications discussing and measuring social capital (Woolcock & Narayan 2000; Aldridge et al. 2002) and national and international policy initiatives (Halpern 2005). A simple word search on ‘social capital’ in the Web of Science academic literature search engine (Figure 4-1) reveals that the number of publications has grown steadily since 1990.[51]

[51] The search was conducted by the research author on 5 July 2010 across all document types in English for each year since 1990, i.e. the year of Coleman’s (1990) publication, in which year there were zero (0) results. The Web of Science indicated that the search included literature from the following sources: Science Citation Index Expanded, Social Sciences Citation Index, Arts & Humanities Citation Index and Conference Proceedings Citation Index- Science. This does not include policy documents, published books, reports or any other documentation in that time period.

Figure 4-1: Number of papers with "social capital" as a topic, 1990-2009, in Web of Science search



Internationally, the Organisation for Economic Co-operation and Development has recognised the impact that social capital can have on societal well-being (Cote & Healy 2001). The World Bank (2004) also supports the social capital concept as a means to alleviating poverty and working for sustainable social and economic development. In the UK, the Performance and Innovation Unit of the UK's Cabinet Office addressed the policy options for social capital in the country (Aldridge et al. 2002), concluding that social capital is a concept which can be applied to many different policy areas and can offer "policymakers useful insights into the importance of community, the social fabric and social relations at the individual, community and societal level" (Aldridge et al. 2002, p.73). They do admit, though, that the outcomes of social capital can lead to conflicts if ties within communities become so close that they exclude anyone who is not considered part of those groups. In the UK, the Office of National Statistics implemented the Social Capital Project, a research programme that established and agreed a set of harmonised themes and questions on social capital to be used across government surveys which have been fully or partially implemented in a number of national surveys (Harper 2001). The resulting 'Social Capital Survey Matrix' allows researchers to examine and use the identified survey questions for social capital measurement (Rustin & Akinrodoye 2002), largely according to the 'collective' conception of social capital.

The theory of social capital has developed since the seminal works of Bourdieu, Coleman and Putnam in different directions. Two of these specific lines of development are explained in the next two sections.

4.3 'Collective social capital' theory & measurement

Definitions of social capital, as above, have emphasised both the individual benefits (particularly Bourdieu and Coleman) and community benefits (more so in Putnam) that accrue as the result of social capital. Conceptually, these benefits can lead to very different interpretations. If benefits are at the individual level, then the unit of measurement will be the individual, as embedded in a network of social relations, and the outcomes will be only for that individual. If the benefits are at the community level, the individual's benefits are expressed as part of a whole community. Several analyses of these and other social capital definitions led to distinctions between what are often referred to as the 'communitarian' and 'network' approaches to social capital (Woolcock & Narayan 2000;[52] Moore et al. 2005; Mitchell & Bossert 2007; Johnson et al. 2007). As social networks are actually integral to both the 'communitarian' and 'networks' view, it is more useful to discuss these different approaches with terms that refer to their units of measurement. Thus, the communitarian view is here referred to as 'collective social capital' and the network view as 'individual social capital' (van der Gaag & Webber 2008).

The 'collective social capital' view focuses on local community and voluntary organisational activity whilst the 'individual level' view focuses mainly on the connections between people (Woolcock & Narayan 2000). Those who support the 'collective level' approach "look at the number and density of these groups in a given community [and] hold that social capital is inherently good, that more is better, and that its presence always has a positive effect on a community's welfare" (Woolcock & Narayan 2000, p.229). Social capital is most often seen as the independent variable which has a positive impact on dependent, outcome variables of, for example, health and well-being (Kawachi et al. 2004). The measurements are based on the definitions, which largely focus on concepts of either trust, or norms and reciprocity, or both.

[52] Woolcock & Narayan (2000) further indicate two other views: the institutional view and the synergy view. However, the emphasis within the institutional view of 'civicness' and the dependence of social capital on good governance is conceptualised and measured in a similar manner to the 'communitarian view' so is here considered part of it. The synergy view is defined as a combination of the networks view and the institutional view, and is the approach the authors advocate. However, it is not clear how this differs in measurement from a communitarian view. Other authors (Moore et al. 2005) focus simply on the communitarian and networks view, and the scope of conceptualisation is here confined to these two approaches.

Many social capital studies choose to focus empirical investigations on reported levels trust (Subramanian et al. 2003; Li et al. 2005; Mitchell & Bossert 2007). For example, though they state that trust is not the only element of social capital, Subramanian et al. (2003) solely employed the metric of trust in their investigations "because trust ... has been consistently used ... [to show] ... significant effect[s] on health" (p.36).[53] Others focus definitions and measurement almost strictly on social norms. Investigating the necessity of social capital for theories of development, Fukuyama (2001) defines social capital as "an instantiated informal norm that promotes co-operation between individuals" (p.7) and further states that it is "simply a means of understanding the role that values and norms play in economic life" (Fukuyama 2002, p.24). Defined in this way, it could then be argued that all elements of social interaction are classified as social capital, which leads to questions of the utility of the concept of social capital over and above values and norms. Woolcock & Narayan's (2000) definition appears to clarify the the usefulness of social capital; the authors see a consensus emerging that social capital "refers to the norms and networks that facilitate collective action" (p.70). It is the 'collective action' that distinguishes normal social life from social capital using the 'collective level' definition of the term.

Putnam (1993, 2000) defined social capital as including both trust and norms, in addition to social networks and reciprocity. This definition is the most widely recognised, particularly within the 'collective social capital' branch. Putnam's (2000) research for *Bowling Alone*, for example, included a large-scale extensive national postal survey in the United States of questions that included such measures as membership to formal networks, informal activities and networks,[54] levels of general trust, voting activity and levels of political involvement. In addition, Putnam conducted studies of secondary data, tracking memberships of organisations and voting patterns. The conglomeration of these variables has come to be known as the "Putnam instrument" (Paldam 2000; Adam & Rončević 2003). Among other findings, he identifies links between active group membership and positive social outcomes (e.g. well-being, low crime, good health, etc.). His analysis suggests a decline in the number of people who join voluntary organisations (Van Rooy 2001). He also found that charitable giving, spending time with neighbours, organisational membership, voting rates and general trust all showed evidence of decline between the 1970s and 1990s. Putnam (2000) concludes by suggesting that community, which is the "conceptual cousin" of social capital (p.21), is in decline.

[53] The question asked by Subramanian et al. (2003) was "do you strongly agree/agree/neither agree nor disagree/disagree/strongly disagree that people in this neighborhood can be trusted" (p.36)
[54] In Putnam's (1993) research of regional life in Italy, he uses measures of network involvement to represent "social solidarity and civic participation," or more simply "civic-ness" (p.91).

Seeking to understand the implications of Putnam's work in the UK, Hall (1999) studied UK and international surveys from the 1950s to 1990s, examining rates of organisational membership, charitable giving, and social trust. He found, unlike Putnam's findings in the USA, a more robust state of social capital. Organisational memberships in the UK were at similar, or slightly higher, levels in the 1990s compared to the 1950s, though did exhibit a widening disparity between social classes. He attributes any rise in memberships to better access to education, declining rigidity in class structure and government support of community involvement (Grenier & Wright 2006). However, Hall (1999) did find that levels of social trust had fallen, with differences appearing to exist between generations, i.e. younger people had lower levels of social trust. His explanation rests on what he sees as the increase in individualism, particularly during Thatcher's leadership in the UK. Grenier & Wright (2006), in their research and review UK social capital indicators (such as organisational membership, trust, etc.), including Hall's (1999) research, found that the decline and social class disparity is actually much more drastic than Hall (1999) claimed. The authors indicate that forms of organisational participation are concentrated mainly in the middle classes, and emphasise that "the benefits of strong social capital will not be realized by a society where some are highly networked participants and others are left outside to cope on their own" (Grenier & Wright 2006, p.50).

Other measurement considerations in the 'collective social capital' branch have focused on 'ecological' features of the social environment. Lochner et al. (1999) agree that a collective level definition is particularly distinct from the networks approach:

> "Social capital is a feature of the social structure, not of the individual actors within the social structure; it is an ecologic characteristic. In this way, social capital can be distinguished from the concepts of social networks and support, which are attributes of individuals" (p.260).

Subramanian et al. (2003) specifically follow the Lochner et al. (1999) definition, admitting that the ecological level "presents some measurement challenges" (p.34), but reconcile these difficulties by measuring through both ecologic observations (e.g. of social interactions in a neighbourhood) and individual surveys.

Those who define and measure 'collective social capital' employ a variety of concepts and means of operationalisation. The lack of consensus has attracted criticism. Fine (2001) accuses social capital of being "chaotic, ambiguous, and [a] general category that can be used as a notional umbrella for almost any purpose" (p.155). Most critics focus on the lack of clarity in the definition of social capital, often questioning whether

social capital is 'capital',[55] the lack of standardisation in testing for the concept, and the expectations of outcomes. Sometimes social capital is seen as the outcome variable, dependent on the organisations or groups that produce it (Foley & Edwards 1999). More often, social capital is the independent variable which affects outcomes such as crime rates (Lochner et al. 1999), health and well-being (Kawachi et al. 2004) and economic performance (Halpern 2005; Hall 1999). There is an assumption in these outcomes that more social capital is a good thing. However, there are instances where social capital does not promote broad social cohesion, and is considered a group (or club) 'good', to the exclusion of the public good (Portes 1998). Old boys' networks, groups that exclude women and minorities, and the Mafia can use social capital as a club good, which is non-inclusive, socially disadvantages people and can have negative effects. The 'collective level' social capital conception has thus been accused of ignoring the 'dark side' of social capital (Field 2003). A related critique relates to the fact that community level social capital does not rest equally amongst members of any social system (Glover 2006), meaning that inequality characteristics again lead to social capital being a 'club good'.

4.4 'Individual social capital' theory & measurement

The 'individual social capital' approach focuses on social resources that are embedded in social networks (van der Gaag & Webber 2008). Woolcock & Narayan (2000) indicate that 'individual level' approach (or network approach) emphasises "the importance of vertical as well as horizontal associations between people" (p.230). This branch is credited as having its conceptual foundations in the social network perspective, and particularly the work of Mark Granovetter (Woolcock & Narayan 2000; Lin 2001b).

> "The social network perspective encompasses theories, models, and applications that are expressed in terms of relational concepts or processes. That is, relations defined by linkages among units are a fundamental component of network theories" (Wasserman & Faust 1994, p.4).

A social network contains nodes which are tied (or linked). A node is a person, and the tie is the relationship between the nodes (Kadushin 2004a). Social network analysis is

[55] Lin (2001b) summarises the original meanings of Karl Marx's theories on capital as "part of the surplus value captured by capitalists or the bourgeoisie, who control production means in the circulation of commodities and monies between the productions and consumption process" (p.6). Lin (2001b) indicates that all subsequent theories of capital, e.g. human capital, social capital and cultural capital, maintain the "basic idea that capital is the investment of resources for the production of profit ..."(p.8). The main difference is that Marx indicated that "both investment and profit are vested in the capitalists" (p.8). Lin (2001b) therefore calls social capital (and other capitals) part of a "neo-capital theory" which "essentially modifies or eliminates the class explanation as a necessary and required theoretical orientation" (p.8). In this research here, social capital (assuming the individual level definition) is thus considered a member of the 'neo-capital theories'.

the study of these relationships (Wasserman & Faust 1994; Kadushin 2004a). Social network analysis was forged in the 1960s and 1970s at Harvard, emerging from the convergence of several disciplines, from those focusing on graph theory to anthropological studies of social structure in communities (Scott 2000). Mark Granovetter, who was at Harvard at this time, conducted a study of 282 American professionals and concluded that "those who used interpersonal channels seemed to land more satisfactory and better (e.g., higher-paid) jobs" (Lin 2001b, p.80). Granovetter's (1973) network theory of the 'strength of weak ties' posits that useful information is often found in social circles outside of an individual's own. Thus, those with whom an individual is weakly tied, i.e. an acquaintance, have a greater chance of being in possession of new information that can benefit the individual in finding a good job. This does not mean that close ties will not have information, but that information from close ties may be regarded as already known. The 'strength of weak ties' concept is discussed as a component of the communications channels in the diffusion of innovations, as mentioned in section 3.3.4. The concept of finding useful information and resources in a social network that can be used for direct, instrumental action, is also integral to the 'individual social capital' concept.

The definitions that developed over time in this 'branch' of social capital have been consistently defined as the resources available in social networks. Flap & Graaf (1986) stated that: "An individual's personal social network, and all the resources he or she is in a position to mobilize through this network, can be viewed as his or her social capital" (p.145). Ron Burt's development of structural hole theory[56] led to defining social capital as a "function of brokerage opportunities in a network" (Burt 1997, p.340) or more broadly as "the advantage created by a person's location in a structure of relationships..." (Burt 2005, p.4).[57] Lin's (1999) definition neatly summarises this branch: social capital is the "resources embedded in a social structure which are accessed and/or mobilized in purposive actions" (p.35). Lin (2001b) defines resources as "valued goods in a society, however consensually determined ..." (p.55), which can be material or symbolic (Lin 1999). These resources are often defined by Lin (1999, 2001b) as wealth, status and power. Social resources can also be physical items, such

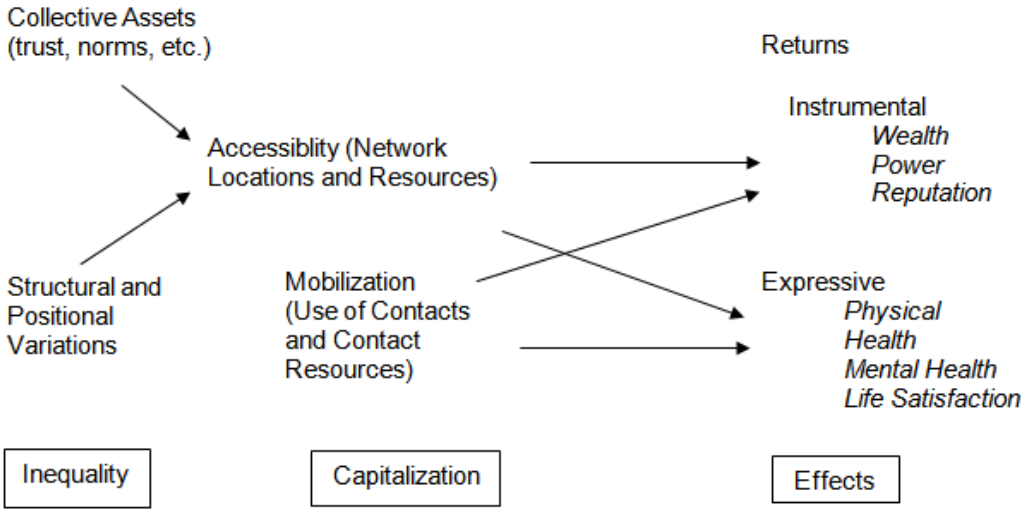
[56] Structural holes are "holes" in the social structure that "create a competitive advantage for an individual whose relationships spans the holes" (Burt 2000, p.353).

[57] Burt (2005) views the concepts of 'closure' and 'brokerage' as the critical elements of social capital. 'Closure' is the condition created by a dense cluster of people formed through informal relations. For example, employees in a large organisation will tend to work with and speak more frequently and informally to the same people in a section or division. Those people who sit between two or more social groups, or areas of 'closure', occupy 'structural holes' and have the power 'brokerage', which is the structural point of a social network where social capital is gained and built (Burt 2005). Thus, in Burt's conception, it is not necessarily 'more' social capital that it better, but structurally strategic positioning within social networks which yields better benefits.

as needing to borrow another person's lawn mower, or more generally can be information (Lin 2007), such as asking neighbours how their solar panels work.

In the 'individual social capital' approach, capitalisation is an investment and consists of the accessibility and mobilisation of social resources embedded in a social network. Accessible social capital is that which is potentially available on a person's network (i.e. able to be accessed at some point in the future). Mobilised social capital is that which has already been used (i.e. retrospectively used resources on a network). Accessible social capital is a precursor – as seen with the directional arrows of Figure 4-2 – to mobilised social capital. As Lin (1999) states, "the general expectation is that the better the accessible embedded resources, the better embedded resources can and will be mobilized in purposive actions by an individual" (p.42).

Figure 4-2: Modeling a Theory of Social Capital (adapted from Lin 2001b, p.246)[58]



Lin (1999) indicates that the expected returns after investment are categorised as instrumental or expressive returns. These returns are the results of what Lin (1999; 2001b) calls instrumental and expressive actions. Instrumental actions are those which are "undertaken to add valued resources not yet at the individual's disposal" (Lin 2001b, p.58), such as power, wealth, reputation or information. Expressive actions, on the other hand, are those which are "undertaken to preserve and defend valued resources already at the individual's disposal" (Lin 2001b, p.58), such as physical and mental health and life satisfaction. In order to gain new returns, or benefits, a person needs to mobilise their social capital to become in possession of that resource. If the resource is information or advice about energy efficiency innovations, a person must

[58] Permission to reproduce the adaptation of this figure has been granted by Cambridge University Press.

ask someone she or he knows for that piece of advice. This is an instrumental action, yielding an instrumental return, which the person can then act on, if she or he chooses to do so. The norms and trust that are the focus of the 'collective social capital' approach are regarded as collective assets which are a necessary foundation for 'individual social capital.' As Sandefur & Laumann (1998) emphasise:

> "An individual's potential stock of social capital consists of the collection and pattern of relationships in which she is involved and to which she has access, and further to the location and patterning of her association in larger social space" (p.484).

Social capital is often discussed in terms of 'less' and 'more'. In general, better access to resources yields 'more' social capital. The benefits of 'more' social capital are the expressive and instrumental returns just discussed. Access to these resources is through the people in a person's (or ego's)[59] social network. But which people do these include? Based on small group studies, Homans (1975(1951)) theorised that it is the combination of interactions with others and sentiment for others[60] which leads to collective activity (Lin 2001b). This theory was extended by Lazarsfeld & Merton (1954) to the principle of homophily, or those 'like me'. As Lin (2001b) indicates, "the homophilous principle of interaction implies a positive relationship between individuals with similar resources and the amount of their interaction", which tends to occur when people are situated "closer to each other in social structures" (p.39). Homophily is thus often linked to the notion of 'strong ties'. However, Burt (2005) has suggested that better resources are available through links to other social cliques, which may be weakly tied and possibly heterophilous (i.e. not homophilous) in nature, which draws on the 'strength of weak ties' proposition (Granovetter 1973). He does clarify that this would be for purposive reasons, i.e. the expectation of instrumental returns, with the implication that homophily is useful for expressive returns.

4.4.1 Measurement of 'individual social capital'

The network view of social capital is based on a definition that emphasises access to and use of resources in social networks. To measure social capital by this definition, there is a focus on identifying exact networks and the resources embedded in those networks. Largely, researchers employing this approach consider social capital the property of the individual, which can then be aggregated to the community or other meso- or macro-level. Thus, measurement often relies on evaluating the structure and characteristics of personal- or 'ego-networks', i.e. all those people (or alters) with whom a person is connected with (or tied to) in a given person's social network. Whole

[59] An ego is a person at the centre of a given network (Wellman 2007). When ego indicates the people with whom he or she is connected (i.e. knows), it is possible to map an ego-network, with ego at the centre and all the named people (called alters) connected to ego.
[60] Interactions instigate sentiment, and holding similar sentiments may instigate interactions.

networks consist of researcher knowledge of all connections between all people within a given population. Whole or partial networks can also be measured, particularly in small networks like organisations, where relationships (i.e. ties) are identified between every single person (or node). Methods of measuring networks include archival research, observation, use of diaries, and experiments, though the predominant method is based on surveys (Marsden 1990). Survey research commonly employs the use of 'generators' to elicit both network structure and the resources within the network members. There are three types of 'generators': the name generator (Johnson 2004; Johnson 2007; Moore et al. 2005), the position generator (Lin & Dumin 1986; Lin 1999; Johnson 2004; Harvey et al. 2007), and the resource generator (Snijders 1999; van der Gaag & Snijders 2004a; van der Gaag 2005; Moore et al. 2005; Harvey et al. 2007).

4.4.1.1 Name generator

The name generator is an established measurement instrument which is based on questions of 'who people know'. Questions that elicit social network information, such as asking about friends and family, have long been asked in surveys (Burt 1984; Klofstad et al. 2009). Burt (1984) explains this history of network generating questions, which began largely in the 1940s and 1950s and was developed by Lazarsfeld & Merton (1954), Laumann (1973), Wellman (1979) and Fischer (1982). "These developments have been extended in scale, if not methodology, during the 1980s to include still more alters, more kinds of relations, more alter attributes, and all of this over time in panel survey designs..." (Burt 1984, p.301). In the 1970s and 1980s social network data began to be standardised and was encouraged for inclusion in national surveys, most importantly the General Social Survey (GSS) of the United States, an important source of data for sociologists and other social researchers (Klofstad et al. 2009; Burt 1984; Marsden 1987). As van der Gaag et al. (2008) explain, the initial 'standard' network generator question which was included in the GSS asked was: "with whom do you talk about personal matters?" and originated from research by McCallister & Fischer (1978) and Fischer (1982). This question focuses responses on close ties with whom "specific matters of a personal nature have been discussed. What those matters are is left up to the respondent - and is likely to vary from respondent to respondent" (Burt 1984, p.317). Name generators often use the 'personal matters' question, but they can be used to ask other questions. They have been used to ask such questions as: "If you need help in and around the house with odd jobs, like moving furniture, holding a ladder, whom do you ask?" (Roper et al. 2009, p. 50) in a survey asking how people found new homes, and: "With which of your colleagues did you have contact concerning work outside of the workplace (such as a telephone call in the evening)?" in a survey focusing on job satisfaction (Flap & Volker 2001, p.317).

Construction of a name generator and name interpreter are therefore not completely standardised, particularly outside the GSS. There are no rules for the number of names to ask, though studies generally limit the number to between one, five (Vehovar et al. 2008), six (Marin & Hampton 2007), ten (Vehovar et al. 2008), though reach up to thirty (Vehovar et al. 2008). In reverse small world studies,[61] as many as 250-300 names have been sought (Marin & Hampton 2007), though asking this many names causes respondent burden (Marin & Hampton 2007) and can lead to high amounts of variability in the data (Lin 2001b). Lin & Erickson (2008) indicate that the number names requested are generally between "three to five, and never more than a dozen or so" (p.12).

Once a name is obtained, questions are generally asked about all, or a selection of, the people. These questions constitute the name interpreters. The name interpreters include questions of relationship qualities of the named social contacts with the respondent, topics that were discussed, how long the respondent has known the named person, relationship between alters, or other demographic details of the named person such as age, occupation, etc. (Burt 1984; Marin 2004).

The name generator seeks names or initials for particular exchange situations (Johnson 2004; Marin & Hampton 2007). These exchanges can already have taken place, in which case they would be classified as mobilised social capital. Or, the exchanges could be hypothetical or possible, and thus be classified as accessible social capital. Van der Gaag (2005) indicates that the name generator is most appropriate when:

> "one of the following types of social capital information is needed: 1) detailed specification of relationship strength in terms of reciprocity or exchanges 2) the estimation of network size 3) investigations of social network structures" (p.200).

The drawbacks of name generators include lengthy administration times (van der Gaag 2005), lack of comparability between studies due to non-standardisation (Lin 2001a), and often superfluous information (van der Gaag & Snijders 2004b).

[61] Small world theory is based on "the principle that most of us are linked by short chains of acquaintances" (Kleinberg 2000, p.845). "This model is based on early experiments in which source individuals in Nebraska attempted to transmit a letter to a target in Massachusetts, with the letter being forwarded at each step to someone the holder knew on a first-name basis. The networks underlying the model follow the 'small-world' paradigm: they are rich in structured short-range connections and have a few random long-range connections" (Kleinberg 2000, p.845). The reverse small world study experiment asks respondents to give details on named intermediaries, having presented them with the same idea, allowing inferences to be made without the full experiment taking place (Killworth & Bernard 1978).

Name generators are generally asked in face-to-face design modes (Vehovar et al. 2008; Marin & Hampton 2007), though telephone surveys have been shown to be just as, if not more, reliable and valid (Kogovsek & Ferligoj 2005). Computer-assisted personal interviewing has been shown to be a difficult method of administering name generators (Marin & Hampton 2007). Though less common, name generators have also been used in internet surveys (Vehovar et al. 2008) and self-completion questionnaires (Marin & Hampton 2007). As studies have shown that interviewers have an effect on the size of elicited networks, constituting a non-sampling error (Van Tilburg 1998; Marsden 2003), Marin & Hampton (2007) suggest that self-completion questionnaires may be a useful alternative, especially if costs are prohibitive for face-to-face interviews, although there is no evidence that the interviewing and questionnaire modes have been tested and compared.

4.4.1.2 Position Generator

Whilst the name generator focuses on social network data and the resources that have been mobilised, the position generator focuses on clarifying the "relationship between social resources and instrumental action" (Lin & Dumin 1986, p.365). As explained above, instrumental actions elicit instrumental returns, which are those that lead to gaining additional resources. As designed, the position generator is meant to ascertain the location of social resources accessible in a social hierarchy which can ultimately be accessed to help ego successfully gain instrumental returns, such as finding a job.

The position generator originally was created by Nan Lin & Mary Dumin (1986).[62] The position generator lists structural positions in society, usually occupations, and asks the respondent to indicate if they know anyone in each position (or occupation) (Lin 2001b). This is meant to indicate how far up (or down) a respondent can "reach" in their social hierarchy (Lin 2001b). "Instead of counting and measuring data from specific names (persons) generated, the position generator counts and measures access to structural positions" (Lin 2001b, p.88). Access to a certain position is the "indicator of social resources" (Lin & Dumin 1986, p.370) and "an individual who occupies a higher position has a greater command of social resources" (Lin & Dumin 1986, p.366). The benefit of the instrument is that it can be compared relatively across populations or countries.

[62] In the original study, Lin & Dumin (1986) created a list of occupations based on the 1970 American census, "a set of high-frequency occupations which spread across the white-blue and upper-lower occupational divisions as well as representing the full range of scores on the Duncan SEI scale were selected" (Lin & Dumin 1986, p.371). Duncan's Socioeconomic Index (SEI) is a "measure of occupational status" which was initially developed using "age-standarized education and income levels of male occupational incumbents from the 1950 [US] Census of Population ... [used to] predict prestige" (Nakao & Treas 1992, p.1), which has since been updated. Respondents were then asked if they knew anyone in any of the listed occupations who was a family member, friend or acquaintance (Lin & Dumin 1986).

> "The logic and theoretical rigor behind the instrument's operationalization enable the development of a position generator for every society in which occupations, occupational prestiges, and/or job-related socioeconomic indices have been cataloged" (van der Gaag et al. 2008, p.27).

The position generator has been popular as it examines the "productivity of general individual social capital ... that do[es] not focus on a particular life domain" (van der Gaag et al. 2008, p.27). The position generator is designed particularly to measure accessible social capital. There are many empirical studies which use the position generator in assessing the contact status in relation to job searching (Lin 2001b). Johnson (2004) also employed a position generator, as well as a name generator, in order to understand measures related to strength of tie and social status when respondents need to find important information. The mode of data gathering has largely been conducted in face-to-face interviews (Lin & Dumin 1986; van der Gaag et al. 2008; Johnson 2004), but has also been used in self-completion questionnaires (Behtoui 2007; Enns et al. 2008).

4.4.1.3 Resource Generator

The resource generator was created by Tom Snijders (1999). Like the position generator, it does not ask for names. However, unlike the position generator, it does not list social positions or occupations, but instead uses a "checklist" of social resources (van der Gaag & Webber 2008, p.41). The resource generator asks about a fixed list of resources, "each representing a vivid, concrete sub-collection of social capital, together covering several domains of life" (van der Gaag 2005, p.138). It is designed to measure access to 'general' social capital (van der Gaag & Snijders 2005), by asking about a broad range of resources. These resources are meant to cover all realms of everyday life that are accessible to people within a given country or culture, which is why they are called 'general'. It is measuring resources that are potentially available within a person's entire network, and thus focuses on accessible social capital, not mobilised social capital. As developed further by van der Gaag & Snijders (2004a; 2004b; 2005), everyday actions are divided into life domains. Different domains provide information about different types of returns, and the resource generator has been designed to elicit information on both expressive returns and instrumental returns (Pinkster & Volker 2009). The original resource generator consists of a generic question which stated: "Do you know anyone who ..." and was followed by thirty-seven questions such as "Can repair a car, bike, etc.," "Knows a lot about governmental regulations," and "Can help when moving house (packing, lifting)" (van der Gaag & Snijders 2005, p.12). The authors then used item response theory (IRT)

models[63] to derive the domains, which van der Gaag & Snijders (2005) concluded consisted of four domains of social capital, namely: "'I. Prestige and education related social capital', 'II. Political and financial skills social capital', 'III. Personal skills social capital', and 'IV. Personal support social capital'" (p.15). The first three are meant to reflect the social capital which can be accessed for instrumental purposes, i.e. to gain additional resources, whilst the latter is meant to reflect the social capital which can be access for expressive reasons, i.e. to maintain social resources.

The resource generator was originally designed to be administered through face-to-face interviews (van der Gaag & Snijders 2005). The respondent was asked to think of a family member or close friend when answering each question. A subsequent version of the resource generator was developed in the UK to reflect resources that are more culturally attainable to British people. This questionnaire was tested in several different ways before a final resource generator was constructed, consisting of twenty-seven items (Webber & Huxley 2007).[64] Using IRT,[65] the authors found four domains of social capital, which they labelled: domestic resources; expert advice; personal skills; and problem solving skills (van der Gaag & Webber 2008, p.37). This survey was constructed as a self-completion questionnaire and respondents were asked to indicate if the resources were accessible through a list of people that varied by relationship to the respondent: immediate family members, wider family members, friends, neighbours, colleagues or acquaintances.

A benefit of the resource generator is that it "combines the economy of the position generator with the content validity of the name generator / interpreter method, because of its vivid measurement of social resources" (van der Gaag & Webber 2008, p.41). It also allows for relatively quick administration, as it requires only ticking about thirty boxes and does not ask for names to be listed (van der Gaag & Snijders 2005).

A drawback of the resource generator is that it is difficult to construct (van der Gaag et al. 2008), although Webber & Huxley (2007) describe a detailed method for testing the instrument and ensuring inclusion of appropriate resources. It is not comparable between populations (or countries), however, as resources tend to be culturally dependent (van der Gaag & Snijders 2005).[66] Another drawback concerns the validity

[63] IRT models are designed to test for latent traits in a similar method to factor analysis, but using variables measured at an ordinal or dichotomous level (van der Gaag & Snijders 2005).
[64] An addition 13 questions were asked by Webber & Huxley (2007) about resources which resided in the respondent him/herself.
[65] Specifically, Mokken scaling was used (Molenaar & Sijtsma 2000), as is described further in Appendix J.
[66] For example, one question in the RG-UK is: "Do you know anyone who ... is a local councillor?" which may not be a pertinent question in countries which either do not have the same terminology or the same construction of local government.

problems that exist for the resource generator, as for many "social resources it is unknown how much people actually know about their social network members. Furthermore, the inclusion of actual resource items in instruments is difficult to achieve with any theoretical rigor" (van der Gaag & Webber 2008, p.41). A final problem occurs when certain items are more popular than others, which may indicate "susceptibility for socially desirable answers" (van der Gaag & Webber 2008, p.41).

4.4.1.4 Generator comparisons

In Martin van der Gaag's (2005) PhD thesis, he conducted research which compared the findings of the newly constructed resource generator with those of a name generator and position generator. In general, he found that each offered different insights to different aspects of social capital. He concluded that studies would not be able to be compared if they used different types of generators, but indicates that:

> "The same finding also offers good news ... The fact that measures from each of the three investigated measurement instruments are independent of each other also implies that each instrument has something to add over another. There are separate aspects of social capital that are each covered by a different measure: the extensity of a network, the diversity of persons and their attributes in a social network, and their resources all concern different phenomena" (van der Gaag 2005, p.196).

Van der Gaag et al. (2008) indicate that the differences between generators is based on the type of social capital effects which are being studied. The position generator is better for instrumental action, but a name generator/interpreter or a carefully designed resource generator (i.e. one which looks at only one domain) may be more useful for eliciting information on expressive actions. Using both resource and name generators may incur a "danger of incomparability between studies" (van der Gaag et al. 2008, p.44-45), but it is also evident that the purpose of an investigation is the key driver in determining which type, or combination, of generators to utilise.

4.4.2 'Individual social capital' critique

Woolcock & Narayan (2000) criticise the networks (or 'individual social capital') approach, as opposed to the communitarian (or 'collective social capital' approach), for limiting the applicability of the "'public good' nature of social groups" (p.234). The 'collective social capital' approach focuses on consequences at a meso-level, i.e. community spirit, civic mindedness, whereas the 'individual level' approach perceives consequences of social capital at the micro-level of the individual (Lin 1999; Yang 2007; Kadushin 2004a), so this criticism would likely be accepted. Though using the individual as the unit of analysis may neglect the community benefits, the definition of resources embedded in social networks does not attempt to try to make any direct

claims about community-level benefits. There are no other critiques that the author is aware which either focus on 'individual social capital' or compare the two branches, but there are critiques of social network analysis, from which social capital is derived. Emirbayer & Goodwin (1994) critically assess social network analysis, "stressing its inadequate conceptualizations of human agency on the one hand, and of culture on the other" (p.1413). They posit that the focus on social structure and patterns of relations "pursues the Simmelian goal of a formalistic sociology[67] ... [and] directs attention exclusively to the overall structure of network ties while suppressing consideration of their substantive content" (Emirbayer & Goodwin, p.1415). The focus on the lack of consideration of culture, and also human agency, are similar criticisms given to the diffusion of innovations, as seen in Chapter 2 and Chapter 3. Though the theories have their limitations, 'individual social capital' appears to complement the diffusion of innovations, the benefits of which have been explained and should provide a useful base for conducting empirical research into household energy consumption.

4.5 Conclusion

Social capital is a relatively new theory which appears to still be in its development, given the lack of overall consensus on definitions and measurements. Two overarching branches emerge from the literature, the 'collective social capital' branch which focuses on the benefits of norms, trust, reciprocity and networks at the community-level, and the 'individual social capital' branch, which focuses strictly on social networks and embedded social resources within those networks. The latter provides a useful tool for examining the communication networks of the diffusion of innovations. Different measurement instruments yield different information on 'individual social capital': the name generator yields either accessible or mobilised social capital, and is used in many studies to elicit information on social support; the position generator yields accessible social capital information based on location in a social structure, which makes it useful to examine, for example, social resources available helpful in finding jobs; and the resource generator measures accessible 'general' social capital of everyday life.

While there are studies which combine the social capital and diffusion approaches in empirical research (Frank et al. 2004; Luke & Harris 2007; Hauser et al. 2007), there are no indications of any research using these two theories for approaching household energy use. It is proposed that the theory and measurement of 'individual social capital'

[67] George Simmel is credited with founding 'formal sociology' is "characterized most especially as the sociology[y] of space, spatiality and spatial relationships" (Scaff 2005, p.6).

can provide valuable insight into process by which energy-reducing innovations diffuse through social networks.

Chapter 5: SOCIAL CAPITAL, DIFFUSION OF INNOVATIONS & HOUSEHOLD ENERGY USE

5.1 Introduction

An assumption that underpins much social research on household energy efficiency is that it is a lack of information that inhibits the diffusion of energy-reducing innovations. If information is sought for purposive action, i.e. to increase knowledge and confidence surrounding any given single or combination of energy efficiency measures, it may lead to adoption of that measure. Seeking resources such as information within a personal social network is an example of utilisation of social capital. At the individual-level, given the stated assumptions about information-seeking and the importance of communication networks for energy efficiency, it is posited here that social capital is an important element in the adoption process of energy-reducing innovations. This type of social capital is here called 'energy social capital' in order to distinguish it from 'general' social capital which pertains to several facets of life. Given the lack of empirical evidence on this subject, however, a research problem is presented: The association between 'energy social capital' and the diffusion and ultimate adoption of household energy-reducing innovations is uncertain. Based on the literature, a model (Figure 5-1) was created to assist in addressing this problem.

Figure 5-1: Theoretical framework

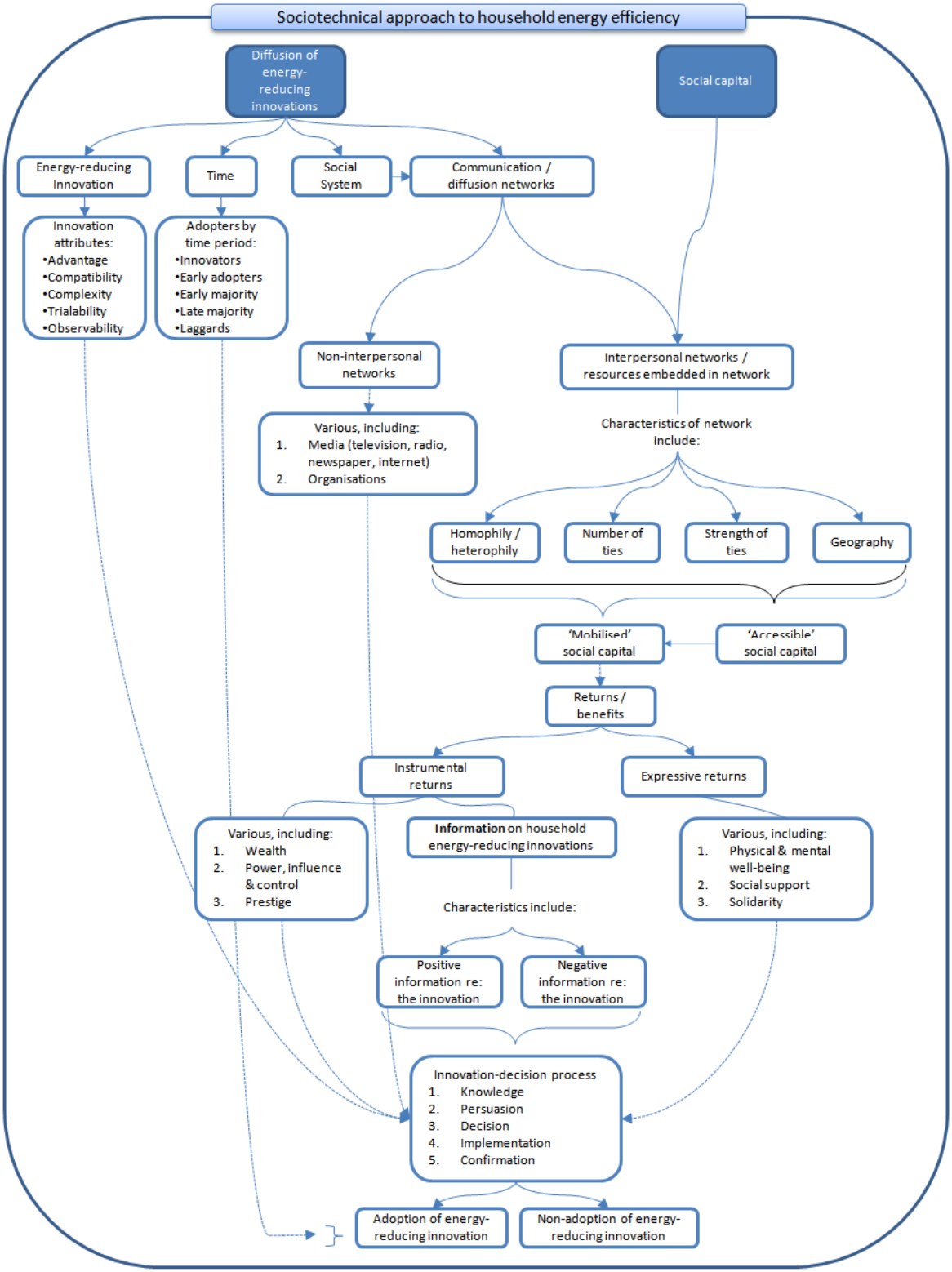


Figure 5-1 integrates diffusion of innovation theory with 'individual social capital' theory, within the context of energy-reducing innovations. The literal 'framing' in Figure 5-1 of the theoretical amalgamation by the socio-technical approach is also a figurative frame. The socio-technical approach is here meant to emphasise the variety of different aspects that influence household energy use, all of which would not be possible to include here. Ideally, this frame would extend to many other theories, approaches and institutions. The 'frame' emphasises the fact that technical elements, or innovations, cannot be investigated without also considering the social system. Cowan (1985) stated that the technology user is "as a person embedded in a network of social relations that limits and controls the technological choices that she or he is capable of making'' (p.202). Communication networks which work for purposive actions are just one of those sets of social relations. The research problem is just one small element in the realm of socio-technical aspects, but investigating it further may help to understand a bit of the puzzle.

Using deductive theory, hypotheses were formed to address the research problem. A deductive approach uses theory to guide research. As Bryman (2008) summarises:

> "The researcher, on the basis of what is known about in a particular domain and of theoretical considerations in relation to that domain, deduces a hypothesis (or hypotheses) that must then be subjected to empirical scrutiny. Embedded within the hypothesis will be concepts that will need to be translated into researchable entities. The social scientist must both skilfully deduce a hypothesis and then translate it into operational terms. This means that the social scientist needs to specify how data can be collected in relations to the concepts that make up the hypothesis" (p.9).

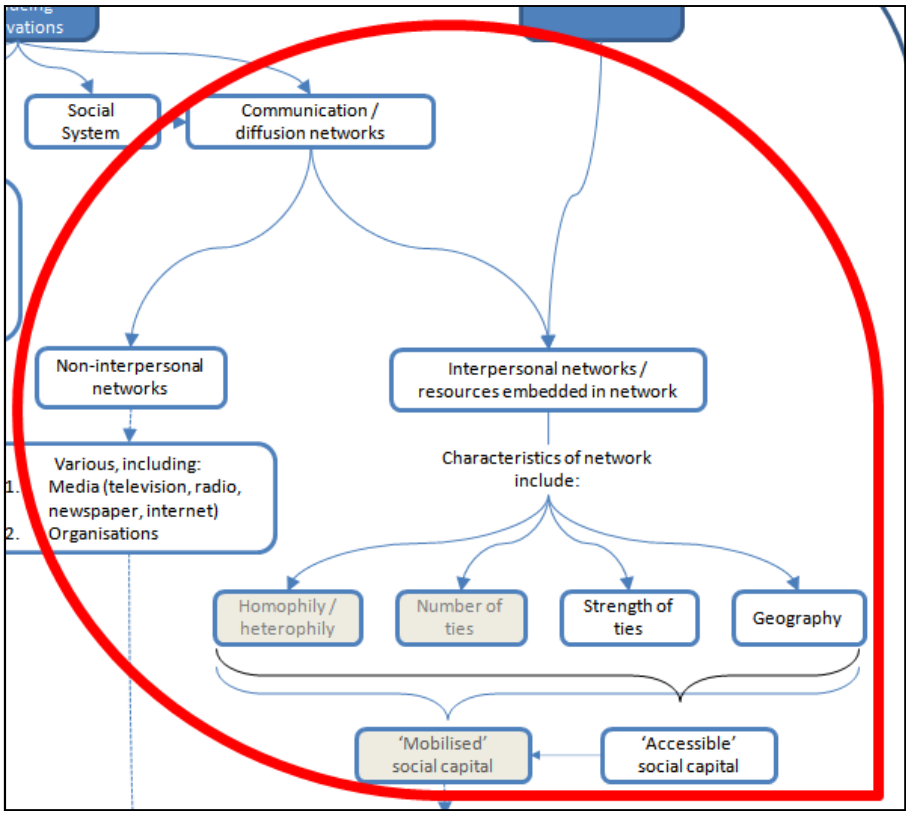
Based on this logic, each hypothesis is described according to the research question which arose from the research problem. Theory guided the observations which were made (de Vaus 2002a). This is referred to as 'theory-testing', which uses "the theory [to] predict how things will be in the 'real' world" (de Vaus 2002a, p.9).[68] An explanation is offered for how each hypothesis was formed, and a description of its basic operationalisation is stated. Operationalisation is the process of "deciding how to translate abstract concepts ... into something more concrete and directly observable" (de Vaus 2002a, p.14). This involves identifying dimensions and sub-dimensions of concepts, and ultimately indicators for each sub-dimension (de Vaus 2002a).

[68] In contrast, theory-building uses inductive logic to first examine observations and then derive theory from those observations. Inductive reasoning, or inductive logic, is "an approach to the relationship between theory and research in which the former is generated out of the latter" (Bryman 2008, p.694).

5.2 Accessible 'energy social capital'

Figure 5-1 can be examined by more closely examining three areas within the model. Figure 5-2 highlights the communications structure, and primarily the interpersonal social networks, of diffusion, which structures the first research question.

Figure 5-2: Model of Research Question 1



Research Question 1: What are the features of the communication structure, and specifically the accessible 'energy social capital', in the diffusion of energy-reducing innovations?

Communication structures consist of "patterned communication flows in a system" (Rogers 2003, p.24). Rogers (2003) further states: "A complete lack of communication structure in a system would be represented by a situation in which each individual talked with equal probability to each other member of the system" (p.24). In reality, a person's communication flows are not random and tend to occur through social networks which that person has already established. Research Question 1 seeks to understand more about these communication structures and patterns. Firstly, it is important to know if people use interpersonal methods communication to find information in the first place. If they choose to speak with people to get information on

energy efficiency innovations, it would then be useful to understand the characteristics of those potential communication structures, such as the strength of the relationship a person has with the people in the communication network and also the degree of propinquity the person has with those people.[69] Three hypotheses, as below, address these issues of the research question.

5.2.1 Personal contacts

The first hypothesis is based on the choice between interpersonal and non-interpersonal networks:

> **H1:** Householders will report that they would be just as likely to access 'energy social capital' as informational sources from non-interpersonal contacts.[70]

This hypothesis assumes that people will not always seek information from other people, but also from other sources, such as the media and professional organisations. In a study of 473 residents in a Canadian town examining attitudes toward energy conservation, Curtis et al. (1984) inquired about information-seeking behaviours. They found that "most people acquired information from television and the newspaper" and that there was "a positive association between the number of sources people utilized to gain information and actions taken to reduce energy consumption" (p.454). This may indicate that media is an appropriate form of communicating energy conservation information in some instances, but they did not ask respondents if they had sought information from personal contacts. Though not focused on energy conservation, Johnson's (2004, 2007) PhD research of social capital and the information-seeking behaviours of Mongolians found that when respondents specifically sought information regarding critical incidents, such as health concerns, respondents were almost as likely to choose other people as their first source of information about a critical incident as other types of sources. When asked where they first sought information, 35 percent said from other people, 34 percent said from organisations and 27 percent said from other media sources (Johnson 2004). This question about where respondents sought information is based on reports of formerly mobilised social capital. Unlike Johnson's (2004, 2007) research, energy efficiency has an 'invisible' nature and would be classified amongst common occurrences, rather than a critical incident. However, it is conceivable that the nature of information-seeking will prompt similar recall of

[69] Homophily and the number of ties are also characteristics of the communication structure, but were not investigated here due to the nature of respondent burden that would arise from a measurement instrument that chose to gather this type of information.

[70] Interpersonal contacts refer to the relationships between people. Here it specifically means relationships between two people who know each other. Non-interpersonal here refers very broadly to relationships that do not occur between two people, or at least not two people at the same level of analysis.

information sources. If Johnson's (2004) question had been seeking information on accessible social capital, respondents would have to imagine their social network, as well as their former information-seeking behaviours, and make a judgement as to what they would hypothetically do, given the need. Understanding the propensity toward accessing interpersonal communication channels, instead of other information channels, will contextualise the extent to which people report accessing and mobilising those resources.

The evidence necessary to address this hypothesis includes information on potential information sources which a respondent would seek. These potential resources will include social contacts (Johnson 2004), media resources (Curtis et al. 1984, Johnson 2004), and organisational contacts (Johnson 2004).[71] The findings will give an indication of which information sources are hypothetically preferred by respondents.

5.2.2 Community

Human geography studies have often emphasised the importance of social networks within local geographic communities in the diffusion of innovations (Hagerstrand 1967; Cliff 1968; Brown 1981). However, as society has become more mobile and communication technologies have improved, the same expectations of 'close knit communities' are no longer assumed to be geographically located (Wellman 2001; Day 2005), and energy-related diffusion is not confined to neighbourhood networks (Darley 1978). However, there is growing emphasis from Government on delivering community-based energy reductions (Walker & Devine-Wright 2008; DECC 2010f; Walker et al. 2010). If information is promoted primarily at community-levels, for example in smart meter trials, it is hypothesised that community members will speak to each other about initiatives in their local area.

> **H2**: Householders will be more likely to report accessible 'energy social capital' with contacts living in the same geographic community.

This hypothesis is formed in part due to an opportunity to conduct household energy efficiency research within in three British communities: a village in England, a village in Wales and a town in Scotland. The intervention programme was initiated by Scottish and Southern Energy plc (SSE), an energy company which trialled the installation of smart meters in a recent government-supported research programme. The programme also involved distribution of energy display monitors to those who could not have smart

[71] Non-interpersonal contact may occur between two people, such as when a person (micro-level) calls an energy efficiency advice centre (macro- or meso-level). However, because the person is calling an organisation, it does not matter who answering the phone at the advice centre, as they should all provide the same information.

meters, and finally encouragement of other established energy efficiency measures, such as insulation installation and behaviour change. In these interventions, information was promoted through engagement with local groups. Because these local groups included established, or newly formed, social networks of community members, it is here hypothesised that diffusion of information may have occurred between physically proximate individuals in the communities. Darley & Beniger (1981) discuss the "neighbourhood effect" with regard to diffusing energy efficiency innovations (p.163), indicating that neighbourhood proximity should be included in models attempting to understand motivations for household energy conservation. Specifically, they indicate that spatial diffusion:

> "is determined by a complex interaction of contact networks and the distance-decay characteristic of individual communication patterns. For this reason, the location of the next specific individual who will adopt an innovation cannot be known with certainty" (p.163).

They conclude by indicating that "degrees of likelihood" of adopting should be assigned to individuals in a social structure (Darley & Beniger 1981, p.164). These degrees of likelihood, or probability, are often unknown at the community level, but could be influential. However, in the same study, the authors note that their hypothesis was proved false: "diffusion proceeds along sociometric rather than spatial networks." (Darley 1978, p.342). Though social network studies originally assumed that geographical proximity was critical in spreading messages (Ryan & Gross 1943; Rogers 2003), there is evidence to indicate that people do not necessarily restrict mobilisation of social capital to geographic boundaries. Perhaps some of the best known community studies involving research on social networks were conducted by Barry Wellman and colleagues in East York, Toronto (Grossetti 2007). In the initial studies, data was gathered from 845 residents of East York, Toronto on the use of 'intimate' networks (i.e. strong ties for social support, etc.). The findings indicated that though many ties (i.e. people available for social support) were located within the larger city of Toronto, only 13% of these ties were within the geographic boundaries of East York, a neighbourhood of almost 105,000 residents at the time (Wellman 1979). Wellman (1979) argued that community had not been 'lost', but instead 'liberated' from its localness to become "sparsely knit, spatially dispersed" (p.1207). Wellman (2001), who admits that he has always believed that "community can be sought in neighborhoods" (p.228), indicates that interpersonal networks work on a place-to-place (i.e. inter-neighbourhood) basis, rather than on a door-to-door (i.e. intra-neighbourhood) basis, in large part due to the advancements in communication technology.

Despite the move toward dispersed social networks, many interventions and studies of energy efficiency attempt to understand diffusion within geographic boundaries (Weenig & Midden 1991; Weenig 1993; Lutzenhiser 2002; Stern 2002). Community-based communication programs for encouraging energy efficiency began in many countries in the 1980s (i.e. The Netherlands, Weenig 1993), though involvement of local communities in the provision and conservation of energy only entered the discourse of UK policy in the 1990s (Walker et al. 2010). Established by the Government in 1993, the Energy Saving Trust[72] established local advice centres, often within local authorities. The purpose of the centres was to act as information resources which householders could approach for advice tailored to the housing needs and local resources in a geographic area (EST 2003). In 1995, the Home Energy Conservation Act (1995) gave responsibilities to local authorities to achieve household energy reductions of 30% within their geographic boundaries. More recently, the *Warm Homes, Greener Homes: The Government's Strategy for Household Energy Management* has encouraged "community partnerships and an enhanced role for local authorities" in the delivery of household energy reductions (DCLG & DECC 2010, p.6). Likewise, the Community Energy Saving Programme specifically encourages energy efficiency measures in geographically-specific areas with greater concentrations of low-income housing (*The Electricity and Gas (Community Energy Saving Programme) Order 2009*). The recent launch of the Low Carbon Community Challenge, which established a fund to support "test-bed communities," aims to "to understand the efficacy of different forms of area-bases community initiatives in leading the transition to a low carbon society" (DECC 2010f [online]). Attention has also been given to community models of energy provision and energy efficiency such as energy service companies (Kellet 2007).[73] Though most energy policies generally address the country as a whole, policymakers still hold a common belief that members of a local community will be able to understand each other's problems and be able to address energy needs with more appropriate information and measures (Kellett 2007).

Though conceptualising social contacts, in general, need not consider physical boundaries, the initiatives at the local level might trigger conversations and instigate respondent recall. The situation of the real-world interventions and the growing policy beliefs therefore lead to the hypothesis that respondents living in clearly designated

[72] The Energy Saving Trust is a non-departmental public body funded jointly by the Government and the private sector.

[73] "The primary objective of the ESCO is to reduce fuel poverty by maximizing the energy purchasing power of the community and seeking to exploit the potential of energy efficiency measures, particularly in the domestic sector. It should be seen as a socially orientated business whose rationale is community development, both in the social, economic and environmental sense, rather than being profit focused" (Kellet 2007, p.392)

communities, i.e. villages and towns, will indicate the ability to access 'energy social capital' with more contacts within their village or town than other contacts outside of the area. This will be operationalised by creating a resource generator to measure 'energy social capital', with answer categories that allow for a respondent to indicate if the person is a neighbour (according to the resource generator of Webber & Huxley (2007)) or in the same community.

5.2.3 Strength of ties

Another characteristic of communication networks which is discussed extensively in both diffusion literature and social capital literature is that of the 'strength of ties' (Granovetter 1973), which leads to the third hypothesis:

> **H3**: Householders will report that accessible 'energy social capital' is available more through weak ties than through strong ties.

Granovetter's (1973) 'strength of weak ties' proposition indicates that diffusion of innovations and information is likely to spread more effectively when accessed through weak interpersonal ties. A weak tie is someone who is "only marginally included in the current network of contacts ... with whom sporadic contact has been maintained" (Granovetter 1973, p.1371). Granovetter (1973) explains that: "an initially unpopular innovation spread by those with few weak ties is more likely to be confined to a few cliques, thus being stillborn and never finding its way into a diffusion study" (p 1367-8). When information is confined to cliques, it can become redundant (Granovetter 1982), due to constant contact and discussions a person is likely to have with those in the clique. The person in question will probably already know, or think they know, what their strongly tied friends and family members know. In order to gain new knowledge, therefore, it may be necessary to seek information about (slowly) diffusing energy-reducing innovations, for example, through weak ties. There are studies which indicate that job-seekers will find information more through weak ties (Lin et al 1981; Granovetter 1973). However, as Johnson Brown & Reingen (1987), most strength-of-weak-tie studies are focused *only* on job-seeking, which calls into question the generalisability of the theory. In addition, even studies on job-seeking found contradictory results. In a study of 299 social and physical scientists at universities in Canada and the USA, Murray et al. (1981) found that respondents actually indicated finding better information of jobs through *strong* ties. However, these studies were all based retrospectively, rather than prospectively. When operationalising accessible resources, questions are addressed as hypothetical situations. When considering accessibility of social resources, a respondent's cognitive answers are not restricted to the limitations that may exist in practice. This means that answers would not be limited

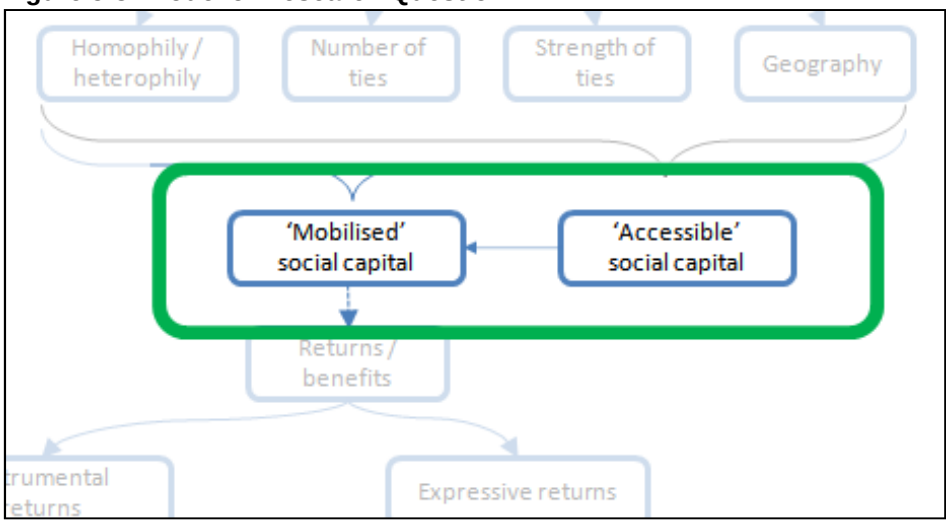
by “communication proximity, defined ... as the degree to which two individuals in a network have personal communication networks that overlap” (Rogers 2003, p.340). In practice, people need to be actively tied to other people in order to have the opportunity, time and inclination to seek information from them. In theory, however, people can think of energy-reducing innovation resources in anyone they have met, no matter how weakly or strongly tied, and may be more likely to report the weakly-ted social resources.

Strong ties have been operationalised in research studies as including intimate relations (Murray et al. 1981), friends and family (Lin 1986; Harshaw & Tindall 2005) and neighbours (Lin et al. 1981). Weak ties have been operationalised as acquaintances (Murray et al. 1981; Harshaw & Tindall 2005) and neighbours (Wellman 1979; Johnson Brown & Reingen 1987), indirect acquaintances, i.e. friends of friends (Lin et al. 1981). For the purposes here, the relationship categories will be based on the categories designated in Webber & Huxley’s (2007) resource generator: immediate family, wider family, friends (strong ties); neighbour, colleague, acquaintance, and the additional category of in the wider community (weak ties). It is expected that when evidence is gathered on the social contacts from whom respondents can potentially access ‘energy social capital’ according to these and other categories, they are more likely to report those who hold ‘non-redundant’ information on energy-reducing innovations, i.e. weak ties.

5.3 Accessibility versus mobilisation

If people do indicate they would access information on energy-reducing innovations, it would then be useful to know how the report of accessible ‘energy social capital’ compares to reported mobilisation (i.e. retrospective social capital). Figure 5-3 highlight the section of Figure 5-1 which is the focus of Research Question 2.

Figure 5-3: Model of Research Question 2



Research Question 2: Will respondents mobilise 'energy social capital' with everyone they know who can offer energy advice?

The hypothesis is:

> **H4**: Householders will report more accessibility to 'energy social capital' than is actually mobilised

In Lin's (2001b) conception of social capital, accessible social capital is a precursor to mobilised social capital. Accessible social capital is itself restricted by pre-existing conditions, such as position in the social structure and social norms. In discussing 'general' social capital, which covers many domains of everyday life, van der Gaag (2005) states that "only a fraction of the accessed social capital is mobilized" (p.202). This is supported by empirical evidence from Johnson Brown & Reingen (1987) on general 'word-of-mouth' referral behaviour of piano teachers: "These data indicate ... that only relatively few of relatively many potential personal sources of information were activated for information flow" (p.358). It is assumed that the very specific domain of 'energy social capital' would behave in the same way. Householders may know of several social resources, in the form of information on energy efficiency and energy conservation, which constitutes accessible 'energy social capital.'[74] However, simply

[74] Accessible 'social capital' entails the social resources that are able to be accessed through the contacts in a person's social network. Accessible '*energy* social capital', as defined here, entails the social resources that pertain to household energy efficiency or conservation which are accessed through contacts in a person's social network. The social resources that are of interest here are specifically information resources in the form of advice or demonstration.

knowing where an information resource is located in a social network does not necessitate mobilisation of 'energy social capital'.[75]

Hypothesis 4 addresses the scope to which 'energy social capital' exists when people might seek information on energy efficiency technologies and energy conservation behaviours. In order to measure *how much* accessible 'energy social capital' is available in people's social networks, a 'generator' (see section 4.4.1) should be constructed. The resource generator measures accessible social capital by asking about general 'resources' (van der Gaag 2005; van der Gaag & Snijders 2005; van der Gaag & Webber 2008; Webber & Huxley 2007). In order to measure accessible 'energy social capital,' it is necessary to create a similar resource generator which only focuses on social resources to attain household energy reductions. By developing a resource generator that focuses solely on the domain of 'energy social capital,' it should be possible to ascertain what resources are accessible. As was stated above, resource generators enable quick administration, though exhibit weaknesses due to difficulty in construction and inability to necessarily compare across populations and cultures (van der Gaag 2005). Building an 'energy social capital' resource generator would thus be very specific to the research design as presented here, and would not be meant as a substitute for 'general social capital'. Nevertheless, the evidence arising would represent a picture of the potential social resources, in the form of energy advice, available to respondents.

Accessible social capital is a precursor to mobilised social capital, so it is assumed that those with whom a respondent mobilises social capital is also available as a potential resource. Evidence for mobilised 'energy social capital' will be gathered using a name generator and interpreter. A name generator measures the three aspects of social capital: 1) the social network, by identifying names or initials of people known to the respondent, i.e. alters; 2) the available resources, as explained in a specific question, e.g. 'with whom would you discuss personal matters...' and 3) mobilisation of social capital, i.e. a social resource which has already been accessed. A name generator can be constructed to also ask about specific types of information sought, i.e. mobilised 'energy social capital.' A name interpreter would follow, asking about the socio-demographic details of a named alter. The results of the name generator and name

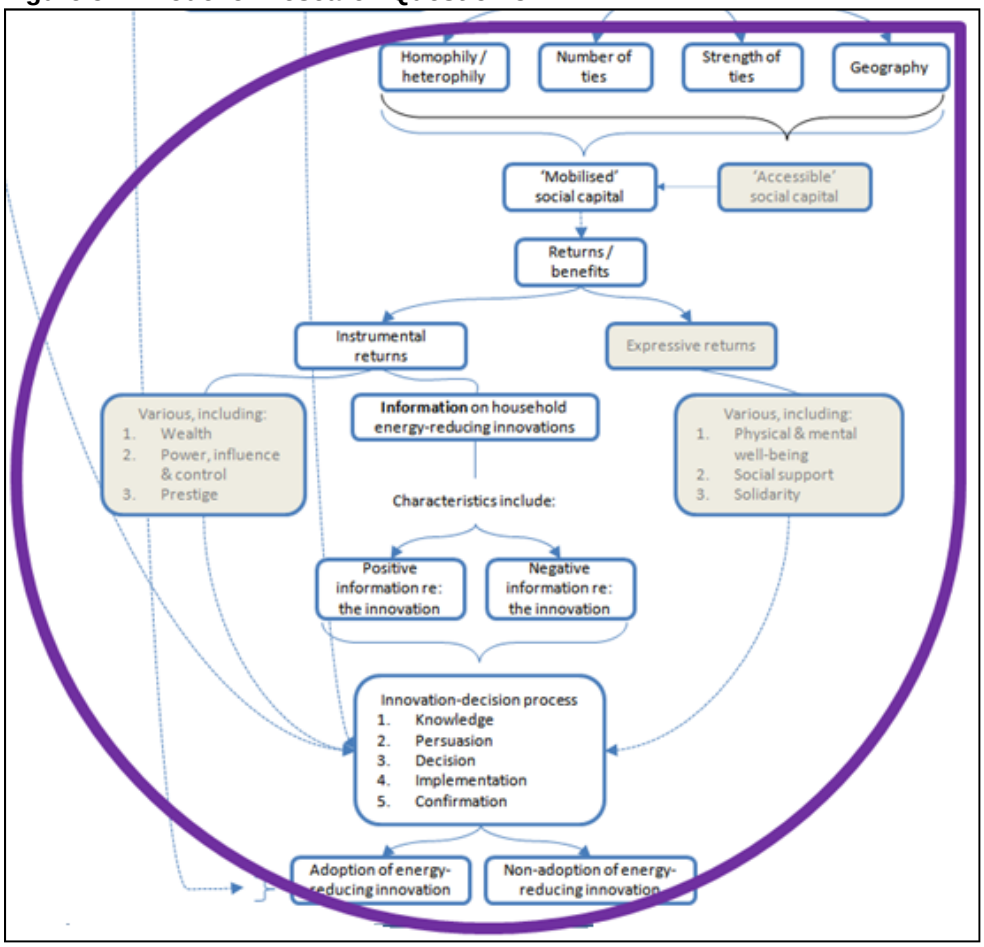
[75] Mobilised 'social capital' entails the social resources that have already been accessed through the contacts in a person's social network. Mobilised '*energy* social capital', as defined here, entails the social resources that pertain to household energy efficiency or conservation from which a respondents has already benefited. The social resources that are of interest here are specifically information resources in the form of advice or demonstration. The meaning of 'benefit' here is taken from Sandefur & Laumann (1998), who "define the benefit of a form of social capital as its particular usefulness to an actor in attaining a specified type of goal" (p.485).

interpreter can then be compared to the accessible 'energy social capital' derived from the resource generator mentioned above.

5.4 Mobilisation and adoption of innovations

Figure 5-4 highlights the mobilised 'energy social capital' from the model in Figure 5-1, which the third research question addresses.

Figure 5-4: Model of Research Question 3



Research Question 3: What are the features of mobilised 'energy social capital' and how is it associated with the reported adoption of energy-reducing innovations?

A hypothesis was formed to address this research question, which contains several sub-hypotheses:

H5: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with:

H5a) those in the same geographic location,
H5b) strong ties,
H5c) homophilous ties,
H5d) a greater number of reported ties, and
H5e) those who offer positive information.

The central statement of Hypothesis 5, i.e. *The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital*, assumes that there are correlations between self-reports of adoption of energy-reducing innovations and the self-reports of speaking with other people to find information (i.e. mobilisation of 'energy social capital'). Initially, the aim was to discover associations between 'energy social capital' and each stage of the innovation-decision process. As is explained further in Chapter 7, the construction of the questions should have allowed for this type of comparison. However, the frequencies were so low in the 'middle' stages of the innovation-decision process (i.e. between 'persuasion' and 'adoption'), that it was felt that examining self-reports of adoptions and non-adoptions would be more instructive. As Rogers (2003) indicates, the innovation-decision process is very difficult to test empirically, "as it is difficult for a researcher to prove the intrapersonal mental processes of individual respondents" (p.195). If the stages are to be more fully examined, it would require a much more intensive examination of the thought processes of respondents.

More generally, there are theoretical and empirical examples that seeking information from personal contacts has an influence on the final adoption of energy-reducing innovations. Darley & Beniger (1981) state that:

> "innovators should report that interpersonal sources of information are more important in encouraging them to innovate than either public interest governmental appeals, communicated via mass-media, or private sector advertising disseminated in the same fashion" (p.168).

The empirical study by Ball et al. (1999) appears to confirm this statement. Using a self-completion questionnaire, Ball et al. (1999) sent a survey to 992 households in New Zealand in two stages in order to determine the respondents' stage in the of the adoption process of compact fluorescent lights and hot water cylinder insulation, i.e. consideration versus non-consideration and adoption versus non-adoption. Achieving a 71% response rate, the results indicated that:

> "First, personal communication is more likely to lead to adoption than is mass communication. Second, the differences between the consideration and adoption models suggest that the role of the communication channels changes during the adoption process. Mass communication may lead to awareness and even consideration, but personal communication is more important than mass communication at the adoption stage" (Ball et al, p.129).

In another study in The Netherlands which also examined the influence of personal communication on energy-reducing innovations, but which did not measure media influence, Weenig & Midden (1991) found that: "The personal communication network

of the community members of the project groups appears to be very important for the purpose of information diffusion" (p.739).

Based on the previous theoretical and empirical evidence, it is expected that self-reported mobilisation of 'energy social capital' will be associated with reports of adoption and non-adoption of energy-reducing innovations.

5.4.1 Community

In parallel to Hypothesis 2 above regarding community, a similar hypothesis is formulated that pertains to Research Question 3, i.e. the association of the geographic location of alters with diffusion and adoption of energy-reducing innovations:

> **H5a**: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', *particularly with those in the same geographic location*.

There are several studies indicating that 10 – 20% household energy reductions are achievable over short periods of time, particularly at the community level (Pallack et al. 1980; Stern 2002). For example, a successful energy efficiency intervention was conducted in Hood River, Oregon in 1983 (Lutzenhiser 2002). A "multipronged social marketing strategy," including dissemination through "word-of-mouth" (Lutzenhiser 2002, p.51-52), encouraged energy efficiency and resulted in a 15% decrease in electricity consumption in the community, a model which Lutzenhiser (2002) indicates has yet to be replicated. Word-of-mouth dissemination is wider than the mobilisation of 'energy social capital', in that it not only includes purposive information-seeking, but also includes information that is gained by chance. Word-of-mouth behaviour was not measured specifically in the Hood River study, but was assumed to play a strong role in information dissemination. There is also evidence that directly links advice from community members to adoption of energy efficiency measures; Weenig & Midden (1991) found that advice from strong ties within a cohesive Dutch community was related to adoption decisions of insulation and double-glazing. Similar evidence from the UK is lacking. The research proposed here intends to investigate these links. It is noted that this may not be expected, as there is research to suggest that sociometric networks are more important than spatial networks in diffusing energy-conserving innovations (Darley 1978). However, in parallel to the arguments made in section 5.2.2, the focus of the subject of research here (discussed further in Chapter 6) is focused on community-level diffusion, which may indicate a propensity for diffusion to occur through local social networks.

The evidence needed to support this hypothesis would include indications that people had actually sought energy-reducing information from neighbours and others in a geographically-bounded community, which could be achieved through a carefully constructed name generator and interpreter, as well as indications of energy-reducing innovation adoption.

5.4.2 Strength of ties

Contrary to Hypothesis 3 above, regarding the strength of ties, it is expected that when asked to actually report retrospective information-seeking regarding energy-reducing innovations, people will actually name strong ties.

> **H5b**: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', *particularly with strong ties*.

The theory behind this does not necessarily contradict Granovetter (1973), but rather builds on his theory. As Rogers (2003) indicates: "Perhaps there is a strength-of-weak-ties in networks that convey information about an innovation and a "strength-of-*strong*-ties" in networks that convey interpersonal influence" (p.340, emphasis authors own).

There is empirical evidence that supports this strength-of-strong-tie proposition. In a study examining the information diffusion and adoption decisions of energy conservation innovations in two Dutch communities, Weenig & Midden (1991) found that:

> "in general, the results support the main hypothesis: Information diffusion is related to the availability of communication ties and unrelated to the strength of ties, whereas adoption decisions are related to the strength of ties" (p.739).

In a subsequent study, Weenig (1993) conducted a similar experiment in two other Dutch communities in order to again test information diffusion and awareness. She reported two findings that are relevant: 1) "Overall program awareness was significantly related to number of *weak* ties and *un*related to number of strong ties and motivation to comply," and 2) "Awareness of specific program activities was indeed significantly related to [the] number of *strong* ties and *un*related to [the] number of weak ties and motivation to comply" (p.1725, emphasis author's own). It thus seems that it was only when asking for more detailed information of programme awareness, in addition to motivation to comply with social contacts, that strong ties played more of a role. She speculates in her conclusion that it is probably easier to remember conversations with strong ties than with weak ties when asked (Weenig 1993). Further, Johnson Brown & Reingen (1987) indicate that perceived influence is associated with strong ties. In their study of social ties and word-of-mouth referral behaviour, which tracked the referrals to

three piano teachers in the suburb of a southwestern American city, they found support for the hypothesis that: “information from strong-tie referral sources is perceived as more influential in receivers’ decision-making than is information obtained from weak-tie referral sources” (p.353).

It is accepted that those considering adopting innovations (i.e. in the midst of, or at the end of, the innovation-decision process) have likely sought information from weak ties. However, at the point of adoption, which is a final stage of the innovation-decision process, it is expected that strong ties will be perceived as influential and thus be reported. Evidence for this hypothesis will be based on inquiring about the adoption or consideration of certain energy-reducing innovations and information-seeking actions. Indications of the strength of tie will also be elicited, and then compared to self-reports of adoption.

5.4.3 Homophily

The third hypothesis related to Research Question 3 concerns the relational property of homophily.

> **H5c**: The reported adoption of energy-reducing innovations will be associated with the mobilisation of ‘energy social capital’, *particularly with homophilous ties*.

“Understanding of the nature of communication flows through interpersonal networks is enhanced by the concepts of homophily and heterophily” (Rogers 2003, p.305). Homans (1975 (1951)) posited that people will want to contact and be friends with people ‘like me,’ i.e. those who are homophilous. In general, a high degree of homophily between two actors will mean they share similar tacit knowledge and possibly similar background and experience, so are more likely to communicate innovation information effectively. Homophily is therefore a characteristic that is beneficial for diffusion (Rogers 2003). Regarding social capital, Lin (2001) indicates that “... interaction implies a positive relationship between individuals with similar resources and the amount of their interaction” (p.39). Lin (2001) further indicates that the homophily principle implies that people will interact with others who occupy similar positions in the social hierarchy. Johnson Brown & Reingen (1987) found evidence that those who activate interpersonal communication to seek referral information are significantly more likely to seek homophilous ties. Rogers (2003) states that homophily can also be a barrier to innovation diffusion, particularly in dense or highly cohesive networks, when information can become redundant. Regarding the diffusion of household energy-reduction innovations, there are no known studies which attempt to seek correlations between homophily and adoption.

There are many different ways in which another person (i.e. an alter) may be like 'me' (i.e. ego). As McPherson et al. (2001) describe in their review of the study of the subject, homophily is often judged on socio-demographic characteristics including race, ethnicity, gender, age, religion, education, occupation, social class, as well as on characteristics such as values, attitudes, and beliefs. As the former (i.e. socio-demographic) variables are much easier to attain from respondents, many studies of community, social capital and diffusion use a combination of these characteristics, such as age (Johnson 2004; Wellman & Wortley 1990; Johnson Brown & Reingen 1987), marital status (Johnson 2004; Wellman & Wortley 1990), gender (Johnson 2004; Wellman & Wortley 1990), educational level (Wellman & Wortley 1990; Johnson Brown & Reingen 1987); occupation and / or occupational status (Wellman & Wortley 1990; Johnson Brown & Reingen 1987; Warde et al. 2005).

In order to investigate homophily amongst respondents, evidence will be gathered on the age range, marital (or living as a couple) status, educational status and gender of the respondent and the people with whom they indicate having mobilised 'energy social capital.' An important caveat to the generalisation of these findings is that even though these are often accepted measures of homophily, they are essentially just considering societal segments via certain socio-demographic characteristics. There may be other ways to gather evidence on homophily which better indicates if a person is 'like me,' but these are deemed to be the least burdensome and least intrusive to potential respondents.

5.4.4 Multiple contacts

The next hypothesis addresses the number of people from whom a respondent will seek information:

> **H5d**: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', *particularly with a greater number of reported ties*.

Some of the earliest work on social networks and diffusion of innovation was conducted by Coleman et al. (1966) and found that the spread of the prescription drug tetracycline by physicians was impacted by the proportion of other physicians who had prescribed the drug (Valente 1996). The more physicians in a respondents' network who adopted the drug, the more likely the respondents was to prescribe it. Valente's (1996) examination of the Coleman et al. (1966) study work was particularly building on Granovetter's (1978) threshold model for collective behaviour, which states that "an individual engages in a behavior based on the proportion of people in the social system

already engaged in the behavior" (Valente 1996, p.70). The exact reason for this 'social contagion' effect has been debated,[76] but it provides evidence that as the number of social contacts who adopted increased, so did the probability that 'ego' (i.e. the physician in question) would adopt.

Further, addressing household energy conservation, Darley & Beniger (1981) speculate that: "Often, multiple tellings of some message may be required before acceptance and adoption occur" (p.166). Stern (2002) posits that there are three different reasons why multiple sources of information influence energy efficiency adoptions: 1) people put different levels of trust in different sources, 2) "different channels may have advantages for conveying different parts of the message," and 3) "multiple channels provide an effective way to repeat and reinforce messages" (p.205).

In order to test this hypothesis, data will be gathered on the number of people from whom respondents sought information. This will then be compared to adoption rates of innovations.

5.4.5 Positive information

The last hypothesis regarding mobilisation is regarding the type of information received.

> **H5e**: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', *particularly with those who offer positive information*.

This hypothesis is largely based on the theory that attitude influences behaviour (Fishbein & Ajzen 1975; Lutzenhiser 2002). The influence of attitudes on behaviour is generally indirect, however. Fishbein & Ajzen (1975) clarify that "traditional measures of attitude toward an object can influence a given behavior only indirectly ..." (p.382), and it is actually accurately measured intentions which are more predictive of specific behaviours. Lutzenhiser (2002) reports that testing of "the Fishbein-Ajzen model found it to be an overall weak predictor of energy conservation" (p.53). However, the Fishbein-Ajzen and other attitude-behaviour theories are generally measuring the attitudes and behaviours within the same person. While receiving positive information from others may influence the attitude of the energy efficiency information-seeker,

[76] Burt (1987) and Van den Bulte & Lilien (2001) both reanalysed data from Coleman et al.'s (1966) diffusion study. Burt (1987) refers to the process of adoption influence as social contagion, indicating that social cohesion is usually assumed to be the cause. However, Burt (1987) argued that structural equivalence, i.e. "the degree of equality in network position" (Valente 1996, p.70), was overlooked and perhaps a stronger cause for adoption in the tetracycline study. Van den Bulte & Lilien (2001) further analysed the data and concluded that it was probably not social network effects that impacted diffusion, but more likely aggressive marketing by the drug company.

there may be other forces of influence that are more inherent to information-seeking, or the mobilisation of energy-social capital. Midden & Ritsema (1983), for example, claim that when considering "...a positive attitude towards energy conservation and normative pressure to conserve energy, the latter can be effective in encouraging the individual to convert a positive attitude into actual behavior" (p.40). The assumption made here is that hearing positive, or favourable, information about an energy-reducing innovation, or the experience with that innovation, may indirectly influence the positive attitude of the information-seeker. Conversely, negative information may negatively influence an information-seeker. This was empirically tested by Weenig & Midden (1991). In their energy efficiency diffusion experiment in two Dutch towns, they asked respondents in a posttest whether they had received positive or negative advice about insulation. The authors were testing the association of both the type of advice and the strength of tie on the tendency toward adoption. They found that "adoption decisions were only significantly related to strong tie advice, with more positive adoption decisions in cases of positive advice and vice versa" (Weenig & Midden 1991, p. 740-741). It is further likely that the degree of positivity of advice will exert normative influence on a potential adopter (Cialdini 2003). Though it is not assumed to be a direct cause for adoption, positive advice may reinforce other positive messages, encouraging a potential adopter to further consider the innovation.

The evidence that will be gathered will specifically ask about a type of innovation, and whether a specific person gave positive (or not) advice about it. This will then be compared with the respondent's self-report of adoption of the innovation (or group of innovations). Though other factors, such as social norms, are not being measured, it is still anticipated that the findings will yield constructive information about the content of social resources, in the form of positive, neutral or negative information, when considering energy-reducing innovations.

5.5 Conclusion

This chapter established a model for investigating the research aim, i.e. to understand the influence of context-specific social capital on the diffusion of energy-reducing innovations within UK communities. Three research questions were established, and hypotheses were made for each research question, which is summarised in Table 5-1.

Table 5-1: Summary of research questions and hypotheses

Research questions	Hypotheses
Research Question 1: What are the features of the communication structure, and specifically the accessible 'energy social capital', in the diffusion of energy-reducing innovations?	H1: Householders will report that they would be just as likely to access 'energy social capital' as informational sources from non-interpersonal contacts.
	H2: Householders will be more likely to report accessible 'energy social capital' with contacts living in the same geographic community.
	H3: Householders will report that accessible 'energy social capital' is available more through weak ties than through strong ties.
Research Question 2: Will respondents mobilise 'energy social capital' with everyone they know who can offer energy advice?	H4: Householders will report more accessibility to 'energy social capital' than is actually mobilised.
Research Question 3: What are the features of mobilised 'energy social capital' and how is it associated with the reported adoption of energy-reducing innovations?	H5: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital'.
	H5a: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with those in the same geographic location.
	H5b: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with strong ties.
	H5c: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with homophilous ties.
	H5d: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with, a greater number of reported ties.
	H5e: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with, those who offer positive information.

Theoretical and empirical justification was given for each. The next chapter describes how these hypotheses are investigated.

Chapter 6: STRUCTURE OF RESEARCH

6.1 Introduction

Having established the theoretical importance of individual-level social capital during the innovation-decision process of the diffusion energy-reducing innovations, this section will discuss the structure of the research to address the research aim. The first section identifies the research populations for study, which arose from an opportunity to evaluate a 'real world' energy intervention in three British communities by a UK-based energy company. The appropriate research designs for empirical investigation are then examined, the research evaluation criteria are reviewed, and a case study design is chosen. The case study design was chosen due to the applicability to explanatory, theory-testing research and the appropriateness for the 'real life' energy efficiency interventions. Research strategies, i.e. quantitative, qualitative and mixed methods, are then examined and a mixed method strategy is chosen as an appropriate approach for the case study design. Finally, data collection modes are examined and it is concluded that a self-completion questionnaire is the most suitable for gathering case information, and focus groups are the most suitable for gathering contextual information. The logic of this section establishes the structure, laying a foundation for the research methods discussed in Chapter 7.

6.2 Research populations

Scottish and Southern Energy plc (SSE) conducted Government-supported trials to better understand how community efforts contribute to domestic energy reduction (Ofgem 2007; Torriti et al. 2010). These trials are part of a larger project which was largely funded by the Government's Energy Demand Reduction Project (EDRP) (DTI 2007).[77] The purpose of the Government funding was to investigate "what changes energy use, by how much and how long" (Baldock 2007, slide 2). The interventions which the energy companies were encouraged to trial included "initiatives with existing metering, e.g. benchmark bills, displays, advice measures, etc.; remotely read meters; smart meters including a visual display unit; time of use tariffs" (Baldock 2007, slide 2). The trials were initially meant to last for two years, in order to cover two winters and two summers. Energy companies were to submit reports of findings on a quarterly basis (i.e. after each season) to the energy regulator, the Office of Gas and Electricity Markets (Ofgem).

[77] Bids were invited from energy companies to participate in the EDRP and those companies which won bids received matched funding to conduct the trials (Ofgem 2007).

SSE won their bid, and the trials were announced on 12 July 2007 (Ofgem 2007). The bid from SSE was unique in that it included additional 'community trials,' in addition to the nation-wide trials expected in the EDRP bids. These 'community trials' would use similar interventions, but focus on energy reductions from whole communities, instead of individual households. SSE chose three communities: one in Oxfordshire, England called North Leigh; one in the Vale of Glamorgan, Wales called St Athan; and one in Perthshire, Scotland called Alyth (see Figure 6-1). These three villages were chosen by SSE because they had a large percentage of SSE customers and either had a local community group active in energy or broader environmental issues, or, in the Welsh village, a willingness to create a group to promote energy efficiency.

Figure 6-1: Indication of location of case communities in the UK[78]

The villages will be described in more detail in Chapter 8, but summary characteristics are presented in Table 6-1.

[78] Map image from http://www.great-rides.co.uk/img/uk_map2.png [accessed 15 Nov 2009]

Table 6-1: Summary characteristics of case study communities

	North Leigh	St Athan	Alyth
Location	West Oxfordshire, England	Vale of Glamorgan, Wales	Perthshire & Kinross, Scotland
Type of community	Village	Village	Town
Amenities	Primary school Memorial Hall Post office Convenience shop Library Small industrial estate Churches (3) Pubs (2) Local paper called the Nor'Lye News	Church School Nursery Library Post office Pharmacy Community centre Several convenience stores Hairdressers Pubs (2) Royal Air Force base borders the village Local paper to the area called the GEM	Town hall Several churches & church halls Small museum Library 100+ registered businesses Several hotels and b&bs Several pubs Garages (approx. 5) Classic car restoration specialist Local paper called the Alyth Voice
Nearest city	Oxford	Cardiff	Perth; Dundee
Number of dwellings	Approx. 800	Approx. 540	Approx. 1,400
Number of residents	Approx. 1,900	Approx. 1,150	Approx. 4,775

SSE set a target for each community to reduce their energy consumption by 10% over the two year period. If the target was achieved, the community would be granted a cash incentive of £20,000.[79] The effort was led by a local community group, with support from SSE.[80] In parallel, and in conjunction with, the community group programmes, SSE rolled out a number of interventions. These were initially intended to work on a systematic basis (Batchelor 2007),[81] but ultimately were tailored to each community. SSE approached their household customers individually, offering an opportunity to have their electricity (and sometimes gas) meters removed and smart meters installed. Other interventions included insulation offers, either free or at a discounted price; vouchers for A-rated appliances; free compact fluorescent light bulbs;

[79] The prize money is to be used for a community-level initiative. The decision of how to use the money will be the responsibility of the local community group, who may choose to ask the community members what they would like to be done.

[80] Each community energy efficiency group, which generally consisted of around 10 individuals, was also given a £30,000 budget over the time period of the trial for promotion efforts, such as events and discounts on energy efficiency measures. In addition, each group adopted a name and a brand (or logo). It was almost entirely up to the community groups to decide how to spend the £30,000, though SSE would make suggestions and had to approve the budget. Each group received further support from SSE in the form of a dedicated person to assist with any needs the groups might have.

[81] The interventions were initially intended to work on a rolling basis, with a new initiative every two months. These rolling initiatives were largely meant to happen in the English village, it seems. However, after a few months, it became apparent that a more flexible approach was easier for the local organising groups.

infrared thermal imaging of homes; and free 'current cost monitors'. The smart meters and the current cost monitors displays are meant to alert householders as to how much electricity they are using at a single point and over time, both in terms of units of electricity and units of money. The purpose is to keep householders informed of their patterns of energy usage. This increased awareness of when energy use changes is meant to inspire the householder to attempt to reduce or change their energy consumption. 'Smart' meters are estimated to assist with reducing energy use by 1-3% (Owen & Ward 2006) or up to 5-15% (Hargreaves 2010), but had not been trialled in the UK on a large scale up to the point of the EDRP trials.

SSE allowed the proposed research in this thesis to take place within the community trials. The communities provided a unique opportunity to test measures of social capital, but there were limitations that are important to the research design. Firstly, it was the energy company and local community groups who had control over the interventions. There was no control by the author. Secondly, the trials were started prior to the establishment of the research design of this thesis, which meant there was little opportunity for any measurement or evidence collection prior to the interventions. Thirdly, the trials were time-limited, which meant that a research design and methods would be restricted to the time-frame established by SSE. Fourthly, the trials were located in rural areas which meant certain logistics needed to be considered when establishing the research design and methods.

6.3 Research designs

A research design is the framework for determining data collection, the "function of [which] is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible" (de Vaus 2001, p.9).[82] The purpose of the research design presented here is to offer a structure for explanatory, theory-testing research. Explanatory research attempts to seek explanations for why something is happening. This is in contrast to descriptive research, which attempts to examine "what is going on" (de Vaus 2001, p.1). The research presented here attempts to understand not only *why* energy-reducing innovations diffuse through society, but also if and how

[82] Research design is not always defined in exactly this way by all authors. For example, Sarantakos (2005), unlike de Vaus (2001) and Bryman (2008), states that "the design explains in some detail how the researcher intends to conduct the work" (p.105), specifically in choosing the topic, methodology, "methodological construction of the topic... sampling procedures ... data collection ... data analysis ... [and] interpretation and reporting" (p.105). De Vaus (2001), however, firmly states that "a research design is *not* just a work plan" (p.9). The research design is here distinguished from research method. A research method "is simply a technique for collecting data" (Bryman 2008, p.31), such as self-completion questionnaires or focus groups, and are discussed in Chapter 7. The research design is also distinguished from the research strategy, which refers to the choice between quantitative and qualitative approaches, according to Bryman (2008), although Yin (2003), for example, uses the terms 'research strategy' synonymously with 'research design'.

information-seeking in the form of 'energy social capital' might influence decisions to adopt. The hypotheses are designed for data to be gathered which seeks probabilistic correlations, between 'energy social capital' and the adoption of energy-reducing innovations. It is understood that there will be many other factors influencing adoption, such as income (Ball et al. 1999), and that there may be intermediary steps between social capital and adoption, so this research is not seeking to identify direct causation. The correlational findings will be based on the structure of the research design as applied to the research questions and hypotheses.

There are six main types of research designs (de Vaus 2001; Bryman 2008): experimental, cross-sectional, longitudinal, case study, comparative, cross-national[83] and retrospective.[84] Appendix B explains these research designs and discusses the appropriateness of application to this research. Table 6-2 briefly summarises each design.

Table 6-2: Types of research designs

Research design	Summary
Experimental	An experimental research design "rules out alternative explanations of findings deriving from it (i.e. possesses internal validity) by having at least a) an experimental group, which is exposed to a treatment, and a control group, which is not, and b) random assignment" (Bryman 2008, p.693-694) and are "…conducted in a laboratory, where all external factors can be controlled" (Sarantakos 1993, p.243). These include laboratory experiments, field experiments, quasi-experiments and simulations.
Cross-sectional	A cross-sectional design "entails the collection of data on *more than one case* (usually quite a lot more than one) and at a *single point in time* in order to collect a body of *quantitative* or *quantifiable data* in connection with two or more variables (usually many more than two), which are then examined to detect *patterns of association*" (Bryman 2008, p.44). Selvin (2006) further indicates that "in the survey the association of the independent and extraneous variables occurs naturally …" (p.175).
Longitudinal	A longitudinal design is one in which data are collected on at least one sample on at least two occasions separated in time, typically using either a cohort (same people) or panel study (samples at two points in time).
Case study	Case studies are useful when a study has a few cases and many variables. A case study research design entails the detailed and intensive analysis of a single or multiple cases (Yin 2003).
Comparative or cross-national	A comparative design "entails studying two contrasting cases using more or less identical methods" (Bryman 2008, p.58).
Retrospective (historic)	Retrospective or historic research designs rely on historic data, and do not focus on contemporary data or events.

As Yin (2003) indicates, each research design has:

[83] Bryman (2008) discusses comparative research design as using different 'cases'. Therefore, a comparative design could be considered part of a case study research design. The primary difference is that comparative case studies usually are cross-national or cross-cultural, "studying [at least] two contrasting cases using more or less identical methods" (Bryman 2008, p.58).

[84] The retrospective, or historical research design, relies on historic data and does not focus on contemporary data or events. This again could be considered to be subsumed within a case study.

> "advantages and disadvantages, depending on three conditions: (a) the type of research question, (b) the control an investigator has over actual behavioral events, and (c) the focus on contemporary as opposed to historical phenomena" (p.1).

An experimental design generally involves comparing a control group with a group that has been subject to a controlled experiment. The lack of control meant there was little opportunity for applying laboratory or field experiment designs. A complete cross-sectional design could have been appropriate, as: the research involves more than one case; the data gathering can occur at a single point in time; quantifiable data can be collected; the aims are to determine patterns of association; sampling logic is appropriate; and a unit of analysis has been determined that is applicable for a survey design (Bryman 2008)**.** The primary drawback is the lack of contextual depth, which would mean missing important messages from the community perspectives. A longitudinal design would have been useful, particularly in understanding different stages of the innovation-decision process. However, the interventions were not organised in a strict chronological order. The time-scale for organising the data gathering meant there was a large degree of uncertainty in potential findings; testing at two points in time might not have yielded useful results. A comparative study between the communities was considered, but comparing communities was not the primary aim of the research questions. A retrospective research design was not considered, given the nature of the current (rather than historic) behavioural and technical interventions.

Based on the advantages and disadvantages of each design, and considering the lack of control over the behavioural energy-reducing events under investigation, a case study design was deemed the most useful and appropriate. A case study research design was chosen due to the flexibility in design and particularly because this type of design considers the 'case' within its unique social context. The case study design is one that entails detailed and intensive analysis of a single or multiple cases (Bryman 2008). As Yin (2003) explains, "the distinctive need for case studies arises out of the desire to understand complex social phenomena" (p.2). It differs significantly from the research designs mentioned previously in that it does not follow the prescriptions of experiments and can be either cross-sectional, longitudinal or comparative.

6.3.1 Case study design

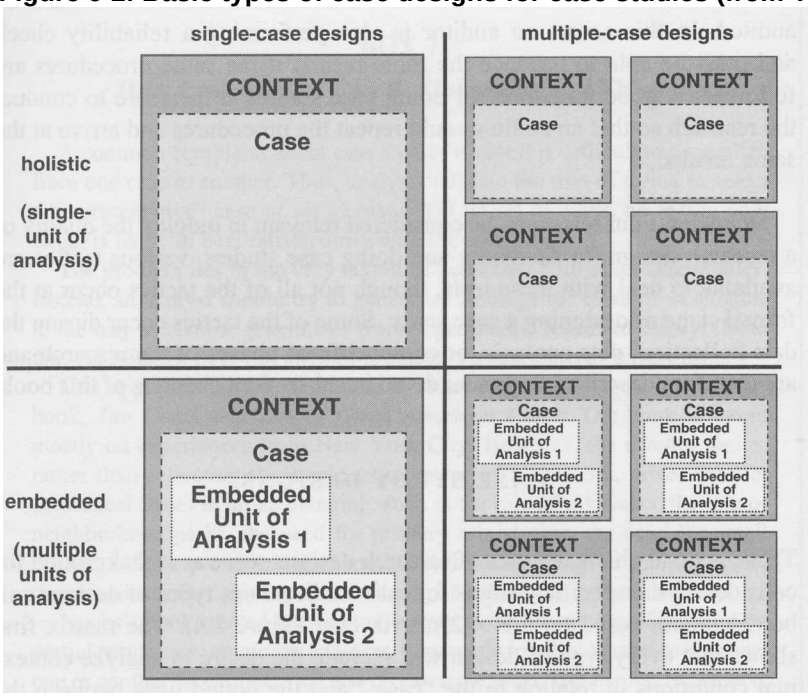
The purpose of a case study is to give a more "complex and fuller explanation" (de Vaus 2006, p.8-9) of the phenomena being studied than other research designs. Case studies seek to achieve a 'deep' view of the phenomena rather than a 'broad' view that could be achieved through a cross-sectional design (Gerring 2007).

A case "connotes a spatially delimited phenomenon (a unit) observed at a single point in time or over some period of time" (Gerring 2007, p.19). A 'case' can be individuals, programmes (Stake 1995), "a location, such as a community or organization" (Bryman 2008, p.53), or processes, institutions, or even events (Yin 2003). Importantly, each case is framed by the context within which it exists (Yin 2003). In the research populations presented here, each community (i.e. North Leigh, St Athan and Alyth) serves as a case. Each case is placed within its own unique context. As de Vaus (2001) explains:

> "The study of context is important because behaviour takes place within a context and its meaning stems largely from that context. The same behaviour can mean very different things depending on its context. Furthermore, actions have meanings to people performing those actions and this must form part of our understanding of the causes and meaning of any behaviour" (p.235).

Case studies may examine single cases or multiple cases. A holistic design examines the case, or multiple cases, in their contexts (Yin 2003). An embedded design examines embedded units of analysis within each case, again whether that is in one case or multiple cases (Yin 2003). Figure 6-2 graphically depicts the differences.

Figure 6-2: Basic types of case designs for case studies (from Yin 2003, p.40)[85]



As each community will be considered a case, and there are three communities, this a multiple-case design. As the hypotheses require answers from those in the community, community members will be considered the embedded units of analysis. Therefore, this will be a multiple-case design with embedded units of analysis.

[85] Permission to reproduce this figure has been granted by Sage Publications.

Case studies can be either exploratory (Yin 2003), descriptive or explanatory (de Vaus 2001; Yin 2003; de Vaus 2006). An exploratory case study seeks to “develop pertinent hypotheses and propositions for further inquiry” (Yin 2003, p.6). Descriptive case studies attempt to “highlight aspects of the case” (de Vaus 2001, p.225), using explicit (i.e. “pre-existing”) or implicit (i.e. what is relevant to the cases) theories (de Vaus 2001, p.225). Explanatory case studies “seek to achieve both more complex and fuller explanations of phenomena” (de Vaus 2001, p.221). This latter approach is more appropriate to the case populations here, as the purpose is to seek the explanations to a number of research questions and test the related hypotheses.

Explanatory case studies can be either theory-building or theory-testing (de Vaus 2001). The “theory building approach to case studies ... develop[s] and refine[s] the propositions and develop[s] a theory that fits the cases we study" (de Vaus 2006, p.9). Theory-testing “begins with a theory, or a set of rival theories, regarding a particular phenomenon” (de Vaus 2001, p.221) which is then tested. It is a theory-testing approach that is being used here. The five hypotheses that were established will be tested to understand and test the diffusion of innovation and social capital theories.

A point that Yin (2003) specifically makes about multiple-case case study design is that it is subject to what he calls replication logic, rather than sampling logic (p.47). Replication logic is compared to multiple experiments, whereby findings from single experiments are replicated to verify what was found. Yin (2003) distinguishes between literal replication, “where there are predicted similar results” (Bergen & While 2000, p.931) and theoretical replication, where contrasting results emerge for predicted reasons. Considering the case study design as presented here, where very similar interventions were made in each of the three case study communities, literal replication is appropriate. Comparison of community findings will enhance the validity and reliability of the findings.

It is also hoped that the use of a case study design will at least partially address the criticisms diffusion of innovations and social capital theoretical approaches have received regarding lack of attention to cultural and social elements. As noted in Chapter 3, the social system within which innovations diffuse has received little empirical examination (Rogers 2003). As further noted in Chapter 4, social network theory, which is the theoretical foundation of social capital, has been criticised for focusing too much on composition of social structure, neglecting the role of human agency and cultural aspects (Emirbayer & Goodwin 1994). The examination of the

context is meant to bring these social system considerations into the analysis, addressing these concerns and developing a more rounded, in depth approach to the research.

6.3.2 Validity and reliability

There are three primary types of validity to consider when constructing a case study design: construct validity; internal validity and external validity. In addition, there are issues of reliability to consider. Construct validity, which is also referred to as measurement validity (Bryman 2008), refers to whether the concept being measured actually reflects the concept in question. For case studies, this type of validity can be increased by using "multiple sources of evidence, in a manner encouraging convergent lines of inquiry" (Yin 2003, p.36); by having experts review the method or methods of data collection; and establishing a "chain of evidence" (Yin 2003, p.36).

Internal validity is "the extent to which the structure of a research design enables us to draw unambiguous conclusions from our results" (de Vaus 2001, p.28). Internal validity relates to the validity of a causal relationship, and is particularly important in research design. It asks the question: does variable X really cause Y, or is there something else which could be producing this result? All research designs will face threats to internal validity (de Vaus 2001), but it is of particular concern with explanatory case study research. Investigations can be designed in such a way to minimise ambiguous conclusions, such as making comparisons between groups, i.e. using one group as a comparison, or gauge, for the other group. This type of internal validity check is used in the research presented here, as the findings from the three villages will be compared to each other (see Chapter 8). Internal validity can also be increased through pattern matching (i.e. "comparing an empirically based pattern with a predicted one" (Yin 2003, p.117)), and by addressing rival explanations and using logic models,[86] i.e. models that stipulate "a complex chain of events over time," (Yin 2003, p.127). As is discussed further below, the nature of mixed methods research when seeking complementarity, or the "elaboration, enhancement, illustration, clarification of the results from one method with the results from another" (Greene et al. 1989, p.259), is also meant to increase validity.

External validity is a difficult test for case studies, as they are often not intended to be generalised to a broader population than the case itself. However, the replication logic above is meant to partially address this in multiple-case studies (Yin 2003).

[86] Gerring (2007) refers to this modelling as "process tracing" (p.172).

Reliability addresses the repeatability of the research. Reliability can be increased by developing a case study protocol (Yin 2003), or adhering to principles of research methods that have been tested (Dillman 2000). Reliability and issues of validity are addressed further in section 7.2.5.3.

6.4 Research strategies

According to Bryman (2008), research strategies refer to the choice of quantitative research, qualitative research, or a mixture of the two, i.e. mixed methods research.[87] Quantitative research emphasises quantification in data collection and analysis, whilst qualitative emphasises words or observations, and mixed methods employ some combination of the two (Durrheim 2006; Bryman 2008).

6.4.1 Philosophical foundations

There are several philosophical distinctions between quantitative and qualitative research, based on ontological and epistemological and other research orientations, such as theory-testing and theory-building. Ontology is "the science of being; deals with the nature of reality" (Sarantakos 2005, p.430). As Bryman (2008) indicates:

> "The central point of [ontological considerations] is the question of whether social entities can and should be considered objective entities that have a reality external to social actors [objectivism], or whether they can and should be considered social constructions built up from the perceptions and actions of social actors [constructionism]" (p.18).

Generally, quantitative research is regarded as having an ontological orientation of objectivism, while qualitative is regarded as constructionism (Bryman 2008).

Epistemology is "the science of science; deals with the nature of knowledge; studies grounds and modes of knowledge acquisition" (Sarantakos 2005, p.426). A positivist epistemology regards the social world as one that "should be studied according to the same principles, procedures, and ethos as the natural sciences" (p.13). This is an empiricist approach, seeking to explain human behaviour (Bryman 2008, p.15), that is often aligned with quantitative research. An interpretivist epistemology, which is often aligned with qualitative research, tries to reflect "the distinctiveness of humans as against the natural order" (Bryman 2008, p.15) and understand – rather than explain – human behaviour. There is also a middle ground of social realist epistemology which "purports to provide an account of the nature of scientific practice" (Bryman 2008, p.14).

[87] Sarantokos (2005) refers to quantitative and qualitative *methodologies*. Regardless of the term employed, it is generally accepted that there is a large distinction to be made between quantitative and qualitative approaches.

The orientation encompasses theory-testing versus theory-building and deductive and inductive logic. Summarised very generally: a quantitative research strategy is generally deductive and considered to test theories (i.e. theory-testing), employing a positivist epistemological approach and an objectivist ontological approach. A qualitative research strategy is generally inductive and considered to build, or construct, a theory based on findings from the research (i.e. theory-building), employing an interpretivist epistemological approach and an constructionist ontological approach. However, "studies that have the broad characteristics of one research strategy may have characteristics of the other" (Bryman 2008, p.23), particularly with mixed methods research, which employs both quantitative and qualitative approaches.

6.4.2 Mixed method research

Case studies do not require a specific type of research strategy; they can be either qualitative or quantitative or both (Yin 2003; Gerring 2007). Case studies popularly employ qualitative research strategies, particularly as case studies have become synonymous with interpretivist approaches, but these are not necessary (Yin 2003). There are no reasons that positivist, deductive research using quantitative data cannot be included in case study design (Yin 2003). The research proposed here is theory-testing and primarily deductive. According to the distinctions above, this would mean a quantitative research strategy is the most appropriate. However, in the case of the research communities being studied, which all vary in different ways, there is a concern about missing contextual information with a purely quantitative survey. Therefore, based on the practical considerations, a mixed method approach has been chosen. A quantitative research strategy is used to collect information on each case (i.e. community) and a qualitative research strategy is used to collect information on the context (i.e. the setting and circumstances of each community). The cases are evaluated by testing theories and the multiple sources of data will develop the deep perspective that highlights the context surrounding each case study community (Mabry 2008; Yin 2003).

Combining different types of research, such as quantitative and qualitative research, is referred to as multiple method research (Mark & Shotland 1987), mutli-strategy research (Bryman 2006), or more recently mixed methods (Greene et al. 1989; Bryman 2006; Bryman 2008). The use of mixed methods research was championed by Donald Campbell from the 1950s onwards (Mark & Shotland 1987) and began to expand in the 1980s (Green et al. 1989). Green et al. (1989) defined mixed method designs as:

> "those that include at least one quantitative method (designed to collect numbers) and one qualitative method (designed to collect words), where neither type of method is inherently linked to any particular inquiry paradigm" (p.256).

Many reasons have been identified for combining quantitative and qualitative research. The original research in the field of mixed methods focused on triangulation and bracketing. Triangulation "presumes that one converges across methods on the answer, on a single estimate that is more accurate than what would have occurred with only one imperfect method" (Mark & Shotland 1987, p.96). Bracketing differs in that it does not assume that different methods will come to the same conclusion, but "provid[es] a range of estimates that is likely to include the right answer" (Mark & Shotland 1987, p.97). A third method, which appears to have been based on analyses of results of triangulation and bracketing, is that of complementary processes (Mark & Shotland 1987), or complementarity (Green et al. 1989). "The *complementary purposes* model holds that, in at least some cases, one uses multiple methods with each method carrying out a different but complementary function" (Mark & Shotland 1987, p.98, emphasis authors' own). Mark & Shotland (1987) identify four variations of the complementary process model, one of which is "described as enhancing interpretability" (p.98).[88] Greene et al. (1989) also identify the complementarity model as one justification for using a mixed method approach, indicating that it "seeks elaboration, enhancement, illustration, [and] clarification of the results from one method with the results from another" (p.259).[89] Bryman (2006) evaluated 232 mixed methods articles and indicates that, in practice, the majority of articles use a complementarity approach. Bryman (2006) attempted to further breakdown the justifications for mixed methods into 18 categories,[90] and reanalysed the 232 articles according to these categories. He found that the majority of multi-strategy methods use the rationale of enhancement (i.e. the variation on complementarity which Mark & Shotland (1987) identified).

The use of both quantitative and qualitative research strategies fits with the aims of the case study research presented here, particularly as "one method is chosen as the primary means of evaluation, and the other plays a subsidiary role of clarification and

[88] The other three variations are: 'alternative tasks', where different parts of a research programme are evaluated (e.g. outcomes and processes); 'assess the plausibility of threats', largely addressing issues of validity; and 'levels of analysis' to examine different levels in the same research programme (Mark & Shotland 1987, p.98-99)

[89] The influential work of Green et al (1989), as described by Bryman (2006), also identified four other justifications for mixed method research: triangulation, as explained above; development, which uses one method to develop the findings from another method; initiation, which seeks to identify discrepancies and develop new paradigms; and expansion, which appears to be closely related to the 'alternative tasks' of Mark & Shotland's (1987) variation on complementarity.

[90] These categories were: triangulation, offset, completeness, process, different research questions, explanation, unexpected results, instrument development, sampling, credibility, context, illustration, utility, confirm and discover, diversity of views, enhancement, other/unclear, not stated (Bryman 2006, p.108).

enhancement" (Mark & Shotland 1987, p.98) in a complementary fashion. However, there are also philosophical issues to address. During the "paradigm wars" of the 1980s (Bazeley 2002), research which mixed qualitative and quantitative methods was criticised for "incompatible epistemological principles" (Bryman 2008, p.606). According to Bazeley (2002), this was "a reaction to the earlier dominances of the 'positivist' world view that privileged objective observation and precise measurement over interpretation of subjective experience and constructed social realities" (p.3). Guba & Lincoln (1994) indicate that the "paradigm wars" could avoid contentious interactions through dialogue, but emphasise the different set of principles upon which qualitative research is predicated, and describe a sort of continuum between the ontology, epistemology and methodology of quantitative and qualitative research. These tensions have not been fully resolved, but have been addressed. For example, three "stances" have been identified in approaching the convergence of paradigms in this way: the purist stance, the situationalist stance and the pragmatist stance (Greene et al. 1989). The purist stance, which argues that paradigms cannot be linked in meaningful ways, has been "increasingly overruled," it is claimed (Bazeley 2002, p.3) by the pragmatist stance, which argues that "paradigm attributes are logically independent and therefore can be mixed and matched, in conjunction with methods choices, to achieve the combination most appropriate for a given inquiry problem" (Greene et al. 1989, p.257) due to practical concerns of "getting research done" (Bazeley 2002). The situational stance sits between the other two, appealing to the purist approach, but indicating that "understanding of a given inquiry problem can be significantly enhanced by exploring convergences in stories generated from alternate paradigms" (Greene et al. 1980, p.257). It is argued here that, though these tensions exist, the heavy reliance on quantitative data is what drives the research here, and as such, paradigmatic underpinnings admittedly lean toward a positivist epistemological approach and an objectivist ontological approach. However, it is also made clear that though quantitative is largely based on positivism and objectivism, it must still be interpreted by a researcher (Bazeley 2002), which involves a certain amount of subjectivity, which is actually the basis of an interpretivist epistemology. This is not to say that the quantitative findings should be considered from an interpretivist approach, but recognises that the lines drawn between paradigms may not always need to be rigid or completely unmoveable. The use of qualitative data in a 'complementary' method here could be argued to be a pragmatist stance, as the objective of the research is to more fully understand the numbers arising from the quantitative methods by putting them in context. As Bazeley (2002) indicates, "where the purpose of the research is made clear, and is theory-driven (i.e. presented through a logical chain of evidence) then that

substantive focus becomes a superordinate goal which limits tensions in mixing of methods..." (p.3).

6.5 Data collection mode

The choice of research strategy has implications for the choice of data collection mode, i.e. how the data will be collected. There are several ways in which both quantitative and qualitative data can be gathered. Quantitative data can be collected by face-to-face methods, by telephone, by post and through electronic mail or the internet (Bryman 2008; Campanelli 2008a). Though face-to-face interviews tend to have good response rates, low nonresponse bias and the quality of answers tends to be very good (Campanelli 2008a), they were not considered due to the high costs (i.e. time and money) involved. Telephone interviews were not considered for logistical reasons, as a sampling frame of phone numbers for community residents would be very difficult to obtain.[91] Internet surveys were not considered, as the population are householders and this mode would be exclusionary, only available to those who have and know how to use a home computer. Postal surveys tend to take longer than the other methods, and have a medium to high nonresponse bias, but they tend to have good response rates (de Vaus 2001). This method was chosen due to the low costs (money) involved (Campanelli 2008a) and the anticipation of good response rates through established methods (Dillman 2000). A self-completion questionnaire is the most common postal collection method (Campanelli 2008a).

Qualitative case study data arises from methods such as examination of documentation (Bergen & While 2000; Yin 2003; Hancock & Algozzine 2006; Mabry 2008), archival research (Scholz & Tietje 2002; Yin 2003), telephone or face-to-face interviews (Scholz & Tietje 2002; Yin 2003; Hancock & Algozzine 2006), direct observations (Scholz & Tietje 2002; Yin 2003; Hancock & Algozzine 2006; Mabry 2008), participant-observation (Scholz & Tietje 2002; Yin 2003), and focus groups (Yin 2003; Torres-Lima & Rodriguez-Sanchez 2008; Bryman 2008). Documentation and archival research was considered, for example, of local papers, but time constraints prohibited this method. As the purpose of evaluating case context is to understand more about the answers respondents offer in the quantitative data collection, it was determined that talking to residents would be extremely useful. Therefore, direct observation (i.e. non-interactive observation) was eliminated. Due to logistical constraints, participation (e.g. through action research which would involve attending meetings, events, and becoming actively involved in local groups promoting energy efficiency) was also not considered. Face-to-face interviews were considered, but time

[91] Private phone numbers are not available or identifiable to the community level.

and cost constraints lead to their elimination and the ultimate choice of focus groups. Focus groups would allow several people to be questioned at once, and the interaction of community members might lead to information that would otherwise not emerge (Myers 1998). Each data collection mode requires specific attention to sampling procedures and participant recruitment, instrument design, and implementation of the data collection, each of which are addressed in Chapter 7.

6.6 Conclusion

Based on the research design questions, the research setting, and previous research designs and findings, there is compelling evidence that a case study design would be appropriate. The research setting consists of three communities (i.e. North Leigh, St Athan and Alyth), each of which could be considered a 'case' in a multiple-case case study. Given the aforementioned applicability of the cross-sectional design, a cross-sectional approach using a case study design was ultimately chosen for the research here. Placed in the broader case study, this allows for the community aspect to be examined for contextualisation of the cross-sectional findings (Leonard 2004; Bryman 2008). The data will be gathered through self-completion questionnaires and focus groups, employing a mixed methods approach, in which the qualitative data acts to complement and enhance the quantitative data.

Chapter 7: METHODS

7.1 Introduction

The chapter begins by describing the quantitative research method employed and provides the bulk of the chapter. This section describes the sampling method and continues by describing the questionnaire design. The self-completion questionnaire content, i.e. the questions formed to address the hypotheses design, is then discussed and is followed by a description of the pre-testing. The next section summarises the process of survey implementation using a method designed to maximise response rates. Issues of validity, reliability and bias are then examined. The next section describes the qualitative method that was used for adding context to the quantitative findings. Focus groups were conducted in each community, and this section describes the method of respondent recruitment, the focus group protocol, and the method of analysis. The next section very briefly describes how the quantitative and qualitative findings are combined in order to present the final findings of the case studies. Finally, this chapter concludes by addressing the ethics involved in both the quantitative and qualitative methods.

7.2 Quantitative research

7.2.1 Sampling method

A cross-sectional quantitative self-completion survey was chosen as the data collection mode for each community (i.e. each case). A sampling method is needed for this specific cross-sectional element of the research design. The standard method of choosing a sample is to determine the population, then establish a sampling frame, and then decide on the sample size and sampling method (Bryman 2008; de Vaus 2002a). A population "consists of all of the units ... to which one desires to generalize survey results" (Dillman 2000, p.196). As there are three case communities, each community will serve as a population. The unit of measurement is a dwelling,[92] rather than an individual. The reasoning for this is that energy-reducing innovations are applied to

[92] The UK Government defines dwellings according to Census definitions, which have changed over time. Most recently, the 2001 Census defines dwellings as "self-contained unit of accommodation ... where all the rooms (including kitchen, bathroom and toilet) in a household's accommodation are behind a single door which only that household can us" (DCLG, *Definition of general housing terms*). However, it is possible to have non-contained households (i.e. multiple households) within a single dwelling of a single address. A household is defined by National Statistics as: "One person or a group of people who have the accommodation as their only or main residence AND (for a group) either share at least one meal a day or share the living accommodation, that is, a living room or sitting room" (ONS 2008a, p.11). As the sampling method only looks at addresses, it is not possible to determine exact households, but the term 'householder' is often used in the research presented here the person sampled at each dwelling, as that person will still exist with a household. This does mean that there may be cases where a respondent is representing a single household within a multi-household single dwelling, the consequence of which is that the person would not necessarily have control over the energy use of the entire dwelling.

dwellings. All those people living in a single dwelling are thus considered as the unit of analysis, because interviewing every individual would lead to redundant information. A single person from a dwelling would act as a proxy for that dwelling.[93]

A sampling frame is "the listing of all units in the population from which the sample will be selected" (Bryman 2008, p.168). A sampling frame was constructed that included as much of the population as possible. There are two universal lists which are common for choosing household sampling frames in the UK: the electoral register and the postcode address file (Lynn & Taylor 1995). The postcode address file "is a comprehensive list of addresses at which mail may be delivered. It was created and is maintained by the Post Office and is organised into Postcodes for the purpose of handling and sorting mail" (Wilson & Elliot 1987). The electoral register is a list of everyone who has registered to vote. The electoral register is a voluntary register and open to anyone above the age of 16,[94] is a British or Commonwealth country citizen, or a citizen of Ireland or a European Union member country (The Electoral Commission, *Voter registration and the electoral roll*). According to Lynn & Taylor (1995), the postcode address file is a better frame for sampling households than the electoral register, as all dwellings should be listed. However, the postcode address file does not contain the names of householders. As Dillman (2000) indicates, personalising correspondence by including a person's name increases response rates. In order to achieve a good response rate, the postcode address file would need to be matched with the electoral register. Since 2000, UK electoral register data are kept in two different versions: the full electoral register and an edited version of the electoral register (*Representation of the People Act* 2000). The edited electoral register contains only those who opted to be included. The full electoral register is not available for commercial companies, but the edited version is available. Though the full electoral register would yield a better sampling frame, the commercially available edited version is 1) available much more readily and 2) adheres to the ethics of not disturbing those who have intentionally chosen to not have their names passed on to any commercial organisation.

A third party was contacted to construct the sampling frame.[95] SSE provided either maps or lists of street names for North Leigh, St Athan and Alyth. This information was then passed on to the third party company. This company created as complete a list as

[93] Though they will often be referred to as respondents, the unit of analysis is still the dwelling.
[94] Voting age is 18, however.
[95] UK Geographics Ltd, http://www.ukgeographics.co.uk/

possible of every household address (excluding businesses) on those streets.[96] The company sent the list to their own supplier who appended one name from the edited electoral register to each address. In addition, this supplier uses information from "other sources in order to complement [the] edited version" of the electoral register (Helic 2009 [electronic mail]). If there were several names at the same address, then the first name on the list was supplied to the third party company.

The list provided by the third party included every known address from each community. A single name was also provided only for those which were matched from the edited electoral register or other sources. As it was decided that the sampling frame would consist of names and addresses, only the matched selections were used for the sampling frame. Table 7-1 indicates the total number of dwelling addresses that were provided by the third party company and the total number of matched names and addresses (i.e. only a portion of the population) which was used for the sampling frame.

Table 7-1: Community populations and total number of dwellings in the quantitative sampling frame

Name of community	Population (Total number of dwellings provided by third party)	Sampling frame (Dwellings with matched names & addresses)	Percent of population included in sampling frame
North Leigh	800	364	45.5%
St Athan	543	330	60.8%
Alyth	1130	782	69.2%

As explained in Table 7-1, only 45.5% of the households were available to be sampled in North Leigh. In St Athan, 60.8% of the households were available. And in Alyth, 69.2% were available (see Table 7-1). Thus, there is bias in the sampling frame. Bias is "a distortion in the representativeness ... that arises when some members of the population (or more precisely the sampling frame) stand little or no chance of being selected for inclusion in the sample" (Bryman 2008, p.168), and constitutes noncoverage error (Dillman 1991; Dillman 2000). There could be something specific about the people who opted out of the edited electoral register that will mean missing nuances in the resulting data. "Noncoverage error arises because some members of the population are not covered by the sampling frame and therefore have no chance of being selected into the sample" (Dillman 1991, p.227). Very often, in large general surveys, it can be difficult to estimate noncoverage error. There are measures which can be taken to reduce the extent of noncoverage error, such as improving the sample

[96] An important caveat is that there may have been confusions as to where streets ended and what constituted the exact boundary of each community. It was necessary to consult several maps, in some cases, and there were discrepancies as to the exact nature of village boundaries. Also, some households may not have been listed for other reasons (e.g. if someone resided at a business address, or if a house was recently divided into flats).

frame, or taking certain efforts when interviewing (Wren et al. 2006).[97] In the current situation, it is possible to make a fairly accurate[98] estimation of noncoverage error, as per Table 7-1 above. In order to understand the non-sampled population, comparisons will be made between available national statistics and the sample obtained, and weighting considered accordingly.

Having established the sampling frame, the next step is to choose the sample size and sampling method. There are standard methods and calculations that are available for determining sample size in relation to accuracy, which aim to reduce sampling error (Dillman 2000; de Vaus 2002a; Folwer 2002). Sampling methodologies were examined (Dillman 2000; de Vaus 2002a; Davies 2004), but it was ultimately decided that the expected number of returns, i.e. final sample size, needed to instead be based on achieving sufficient returns to overcome item nonresponse. "Item nonresponse occurs when a response to a single question is missing" (Groves et al. 2004, p.187). Item nonresponse can severely limit the "statistics produced using data from the affected items" (Groves et al. 2004, p.187). The data collection mode was not standard for the type of questions created. Respondents were asked to name people with whom they had spoken on specific energy-related topics via a questionnaire. There are a few studies which have utilised name generators and name interpreters via self-completion questionnaires on general topics of social networks (Marin & Hampton 2007), but these are much less common than the mode of a face-to-face interview. Considering that questionnaires have a poor ability to handle item nonresponse (de Vaus 2002a), the response for each item was highly uncertain. Once the questionnaire was drafted, professional advice was sought on the resulting technical report from a member of the University of Reading Statistical Services Centre (Barahona 2009). Based on his advice, and in consultation with colleagues, it was decided that the expected nonresponse to some items, particularly around the named 'alters' questions, meant that as many returns were needed as possible in order to address the research hypotheses with a high degree of statistical precision. Therefore, a nonsampling method of employing the entire sampling frame as the 'sample' was considered. As Dillman (2000) indicates:

> "... as population sizes drop lower, a greater and greater proportion of the population needs to be surveyed in order to achieve a given level of precision. This

[97] These additional measures when interviewing include: "establish[ing] clear instructions concerning who to interview, when to interview, and where to interview; ... specify[ing] callback requirements; and ... when possible, verify[ing] or monitor[ing] interviews" (Wren et al. 2007, p.216). These are not of relevance to postal questionnaires.

[98] This is not exactly accurate, as the addresses which were not contacted may not fully cover the whole village, due to discrepancies in determining the boundaries of each village and town, changes in household tenancy, or other unaccountable reasons, particularly compared to 2001 Census data (see Appendix J).

> raises the question of whether one should sample at all, or instead attempt to survey everyone. This question is especially critical for self-administered surveys, in which the marginal costs of contacting additional people is usually less than for interview surveys" (p.208).

In order to obtain results that would be expected to stand up to statistical tests, it was decided to attempt to gain as many responses as possible by surveying the entire sampling frame. This is similar to one of the three general classes of sampling schemes, according to Fowler (2002): "sampling is done from a more or less complete list of individuals in the population to be studied" (p.12). Though it is not the complete list of households, the sampling frame obtained from the third party is the complete list for which all information (i.e. name and address) of a representative householder was gathered. This could be considered a census, "obtained by collecting information about every member of a group; that is, the population" (de Vaus 2002a, p.69), of the sampling frame.

The sampling procedure has direct impacts on external validity. External validity assumes that the final results of a sample can be generalised to the broader population. The best way to improve external validity is to use random sampling (Trochim 2006). Another way to increase external validity is to replicate the study (Yin 2003; Trochim 2006) in other populations, which is the method that has been employed here.

7.2.2 Questionnaire design, content & operationalisation

Much research has been done regarding the design of self-completion questionnaires (Dillman 2000; de Vaus 2002a), and the questionnaire was here developed largely according to Dillman's (2000) Total Design Method. This method "is the development of survey procedures that create respondent trust and perceptions of increased rewards and reduced costs for being a respondent, which take into account features of the survey situation and have as their goal the overall reduction of survey error" (Dillman 2000, p.27).

Physically designing a paper-based self-completion questionnaire requires attention to details such as paper size, font, length, and formatting (Dillman 2000; de Vaus 2002a; Czaja & Blair 2005), as described in detail in Appendix E. The questionnaire was titled 'Energy Efficiency in your Community' and placed on twelve pages of A4 paper (Dillman 2000; Beebe et al. 2007), using between 9- and 12-pt. Arial font (Mallen et al. 2008; Hill 2007), leaving space for instructions on the front cover (Dillman 2000; Shipworth et al. 2010) and blank space for respondent comments on the last page

(Dillman 2000). The text of the ten pages which contained the questions were designed according to proven standards, labelling and grouping sections appropriately, avoiding distracting fonts (Madge 2006) and keeping language simple (Dillman 2000; de Vaus 2002a; Campanelli 2008b).

In order to obtain high internal validity, the questionnaire must elicit responses which reflect what is being measured. Concepts were operationalised based on established methods which were modified to address the topic of household energy use and the hypotheses associated with this research. The first page of the questionnaire included six questions, the development of which are discussed in Appendix E, starting with a simple question to show a "connectedness" between the respondent and the survey (Dillman 2000, p.94): *How long have you lived in [your community]*?[99] This was followed by questions which addressed community satisfaction, awareness of the SSE-backed energy efficiency initiative in the community, whether discussions had taken place regarding the initiative, and respondent knowledge of energy efficiency. Question (Q5), which addresses Hypothesis 1, was also included on this first page:

> **5** **If you had a question about energy use in your home, what would be the FIRST thing you'd do to get information?** Please tick one.
> □ Ask someone I know (for example: friend, relative, colleague, acquaintance)
> □ Check media sources (for example: the Internet, newspapers, magazines, radio or television)
> □ Approach an organisation or group (for example: local council, energy advice centre, energy company)

This question is based on Johnson's (2004) research of social capital and information-seeking in rural Mongolia which yielded results of the same categories, though based on different topics (i.e. 'critical incidents'). Though she used a different survey mode, the "respondents were almost equally likely to choose each of the three types of information sources as their first choice in their search for information. Thirty-five percent chose people, 34% chose organizations, and 27% chose media sources as their first choice of information source" ([online]). Though the topic of research was different, it was anticipated that responses would be proportionately similar. The findings of Q5 were intended to reveal potential or intended actions, rather than actual actions that the respondent has already performed. Though the use of hypothetical questions in surveys is generally discouraged (Fowler 1995), accessible social capital is necessarily a hypothetical construct. As well, this type of information parallels the responses in the Energy Efficiency Resource Generator, which addresses potential, future access to resources.

[99] The name of each community was inserted in the square brackets.

7.2.2.1 Energy efficiency resource generator

The next question section of the 'Energy Efficiency in your Community' questionnaire covered twelve subquestions which make up the Energy Efficiency Resource Generator. The original resource generator was designed to measure accessible social capital, addressing social resources embedded in a person's social network that are *potentially* available to that person (Snijders 1999; van der Gaag & Snijders 2005). The resource generator measures accessible social capital, focuses on both instrumental and expressive actions, asks about certain social resources, and is generally designed to elicit information about strength of tie (van der Gaag & Webber 2008). As the only resources that are necessary to address the research questions are those of energy information, a new resource generator was designed here to focus solely on 'energy social capital'. Thus, the whole objective of the Resource Generator is changed. There is no precedent for building a resource generator that focuses on a single issue, so it is not generalisable to other studies. However, the resource generators developed by van der Gaag & Snijders (2005) and Webber & Huxley (2007) are also limited in their generalisibility, as they are culturally dependent (Webber & Huxley 2007).

The general question of the 'Energy Efficiency Resource Generator' was:

7 "Do you know anyone who ..."

The twelve subquestions, as in Table 7-2, were decided in an iterative process, largely drawing from 604 'frequently asked questions' from the Energy Saving Trust website (EST *Frequently asked questions*, see Appendix C), and respondents were offered answer categories of 'no' or 'yes'.

Table 7-2: Energy Efficiency Resource Generator sub-questions

Energy Efficiency Resource Generator Sub-questions	Reason for including
Do you know anyone who ...	
… would give you sound advice on energy efficiency?	To gain a very general sense of direct available advice
… would help you find information on energy efficiency?	To gain a very general sense of people who could help the respondent
… would give you sound advice on day-to-day household activities to help reduce energy you use in your home?	Compare to behavioural innovations
… would give you sound advice on how to use your heating system more efficiently?	Compare to appliances, heating & lighting innovations
… would give you sound advice on real-time energy displays (i.e. smart meters or current cost monitors)?	Compare to visual display innovations
… is an electrician or works directly with electrical equipment?	Similar to an RG-UK question[100] (Webber & Huxley 2007)
… would give you sound advice on purchasing energy efficient windows?	Compare to the walls, windows, doors & floors innovations
… would give you sound advice on insulating your house?	Compare to the walls, windows, doors & floors innovations
… can explain the pros and cons of having a smart meter installed?	Compare to visual display innovations
… would give you sound advice on purchasing energy efficient heating systems?	Compare to appliances, heating & lighting innovations
… would give you sound advice on purchasing energy efficient appliances for your kitchen?	Compare to appliances, heating & lighting innovations
… knows a lot about DIY?	RG-UK question (Webber & Huxley 2007)

If a respondent ticked 'yes', they were asked to answer: *"How do you know them?"* in order to address Hypothesis 3, i.e. strength of tie. Categories were then offered which paralleled those used by Webber & Huxley (2007) in their construction of the Resource Generator-UK (RG-UK): immediate family; wider family; friend; acquaintance; neighbour; and colleague. Another category was added called 'in [name of community] but not immediate neighbour' in order to address Hypothesis 2, which states that people will look for information within their own community. Respondents were instructed to *"Please tick as many as apply"*, consistent with the RG-UK (Webber & Huxley 2007), as it is conceivable that any given resource could be embedded in a variety of social network members.

The wording for most of the questions in Table 7-2 is based on the Resource Generator-UK (Webber & Huxley 2007), which had questions such as *"Do you currently personally know anyone who would … give you sound advice about money problems?"*[101] Webber & Huxley's (2007) Resource Generator-UK included 27 subquestions. Two of these were included in the Energy efficiency resource generator (i.e. *'...knows a lot about DIY'* and a variation of '*... is a reliable tradesman (eg plumber,*

[100] Webber & Huxley (2007) asked "... is a reliable tradesman (eg plumber, electrician)".
[101] Webber (2008) emailed the author a private copy of the RG-UK on 2 October 2008.

electrician) for their applicability to the general theme of changing things in the house and in order to make comparisons.

7.2.2.2 Innovation-decision stage

It was also necessary to determine at which stage the respondent had reached in the innovation-decision process regarding diffusion of energy-reducing technologies and behaviours. In order to determine which technologies and behaviours to include in the questionnaire, an iterative process was used which was guided by three methods: 1) investigation of the Energy Saving Trust website (EST, *Frequently asked question*), including their advice to householders and frequently asked questions (see Appendix C), 2) observation of the measures which were encouraged by the energy company (SSE) initiating the energy efficiency interventions in the three communities, and 3) review of the literature. Three 'technology' innovation categories were created, as was a fourth 'behavioural' innovation category. The first 'technology' innovation category was called "Walls, windows, doors & floors" and addresses conduction (e.g. insulation) and convection (e.g. draught-proofing) of heat flows through the building fabric of a home. Nine 'technology' innovations were determined for this category (Table 7-3), all of which theoretically require a one-time installation.[102] The second 'technology' innovation category was called "Visual displays of energy use" and addresses technologies that are meant to inspire energy awareness by making energy use visible to the householder, i.e. providing feedback (van Dam et al. 2010). These were determined solely due to the nature of the energy efficiency interventions by the energy company, which specifically offered smart meter installations, made energy monitors available (called Current Cost Monitors by the energy company) and occasionally supported infrared thermal imaging.[103] The third 'technology' innovation category was called "Appliances, heating & lighting" and included several innovations that are installed within homes, as shown in Table 7-3. The final category was called "The way we act in the house" and included ongoing actions involved with the use of appliances, heating systems, and other electronics. These behavioural innovations were largely chosen from Energy Saving Trust recommendations from the website (EST, *Frequently asked questions*) and other documents (i.e. EST 2006) and Government documents addressing energy efficiency (Defra 2007). As well, several academic studies have focused on insulation (Weenig & Midden 1991), lighting (Ball et al. 1999; Menanteau & Lefebvre 2000), and draught-proofing (Weenig 1993).

[102] This is 'theoretical' because loft insulation, for example, may require topping-up to achieve the best performance. In addition, behavioural actions would be needed to use heavy curtains and windows for maximum energy efficiency as stated by experts or manufacturers.
[103] Thermal imaging was not promoted through SSE in St Athan, but is still an available service to anyone, so was included in the questionnaire for consistency.

Table 7-3: Innovation categories and types

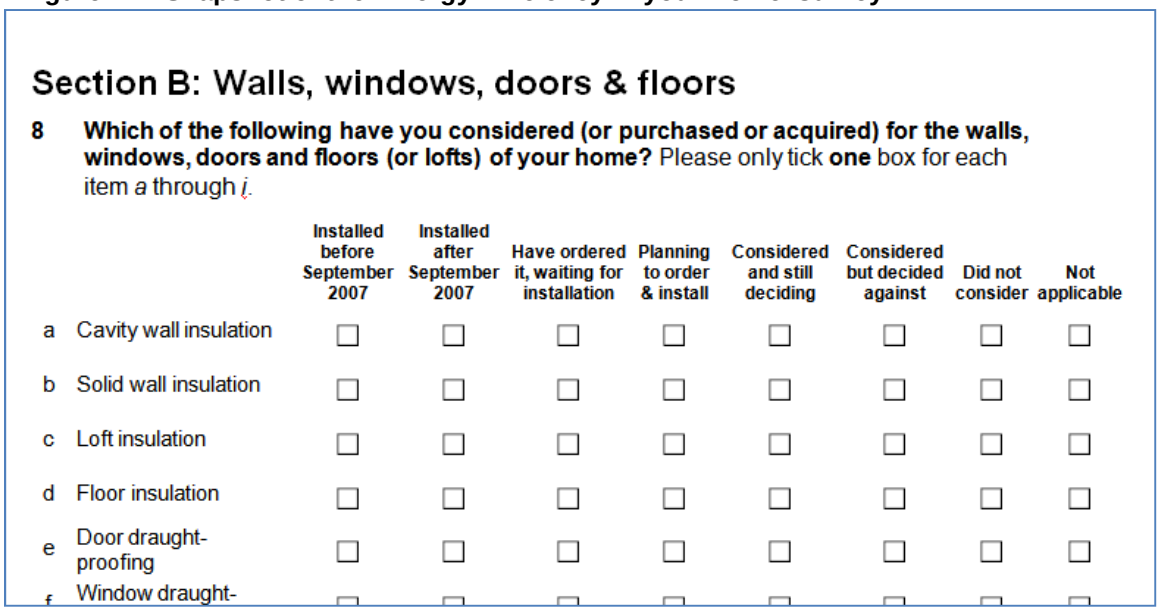
Category of innovation	Innovation
Walls, windows, doors & floors (referred to as *WWDF* innovations)	Cavity wall insulation
	Solid wall insulation
	Loft insulation
	Floor insulation
	Door draught-proofing
	Window draught-proofing
	Heavy curtains for windows or doors to keep heat in
	Double-glazed windows
	Secondary-glazed windows
Visual displays of energy use (referred to as *Visual* innovations)	Smart meter
	Current cost monitor
	Infrared thermal imaging of your home (to identify heat loss)
Appliances, heating & lighting (referred to as *AHL* innovations)	Boiler or heating system upgrade
	Heating controls for boiler or radiators
	Radiator reflectors or panels
	'A' rated large appliances (for ex: refrigerator, etc.)
	Low-energy bulbs in most or all light fixtures
The way we act in the house (referred to as *Behave* innovations)	I switched off items on standby, if possible
	I boiled the kettle with only just enough water
	When it was cold at night, I drew the curtains
	I used heating controls (for ex: timers & valves on radiators and thermostats)
	I turned of electrical equipment (for ex: computers) overnight when it wasn't being used
	I shut off heating in rooms that weren't used

In order to determine rates of adoption and *consideration* of adoption of the technologies in Table 7-3, each phase of the innovation-decision process was operationalised, as demonstrated in Table 7-4 and Table 7-5. The questionnaire asked the following question for each of the three technical innovation categories:

> **Which of the following have you considered, purchased or acquired for your home?**

An item-in-a-series format (Dillman 2000) enabled the respondent to tick one of the indicator boxes, which then gave information of their stage in the innovation-decision process. The two categories "Walls, windows, doors & floors" and "Appliances, heating & lighting" had the same indicators for innovation-decision stage, as shown in Figure 7-1 and summarised in Table 7-4.

Figure 7-1: Snapshot of the 'Energy Efficiency in your Home' survey



Section B: Walls, windows, doors & floors

8 Which of the following have you considered (or purchased or acquired) for the walls, windows, doors and floors (or lofts) of your home? Please only tick **one** box for each item *a* through *j*.

		Installed before September 2007	Installed after September 2007	Have ordered it, waiting for installation	Planning to order & install	Considered and still deciding	Considered but decided against	Did not consider	Not applicable
a	Cavity wall insulation	☐	☐	☐	☐	☐	☐	☐	☐
b	Solid wall insulation	☐	☐	☐	☐	☐	☐	☐	☐
c	Loft insulation	☐	☐	☐	☐	☐	☐	☐	☐
d	Floor insulation	☐	☐	☐	☐	☐	☐	☐	☐
e	Door draught-proofing	☐	☐	☐	☐	☐	☐	☐	☐
f	Window draught-	☐	☐	☐	☐	☐	☐	☐	☐

Knowledge was only generally addressed by asking if the respondent had not considered the innovation. Persuasion was operationalised by asking if the respondent was currently (i.e. at time of filling in the questionnaire) considering the innovation. There were two categories for decision: one for those who were planning to install or acquire the innovation, and a second for those who had already decided to reject the innovation. The indicator for the implementation phase asked if the respondent had already made steps towards acquiring the innovation by asking if the innovation had been ordered from the supplier. A further two implementation indicators, which also act as confirmation indicators, asked if the innovation was already installed. The timing of the installation was a key interest for this indicator, as the research questions were largely aimed at understanding the interventions of the energy company. Therefore, this indicator was split into two questions, asking if the innovation had been installed before or after the date the energy company's intervention.

Table 7-4: Indicators for innovation-decision process for WWDF and AHL innovations

Stage of Innovation-Decision process	Indicator
Knowledge (or pre-Knowledge)	Did not consider
Persuasion	Considered and still deciding
Decision	Planning to order & install (Adoption)
	Considered but decided against (Rejection)
Implementation	Have ordered it, waiting for installation
Implementation / Confirmation	Installed after [date programme started]
	Installed before [date programme started]

The answer categories were slightly different for the 'Visual displays' category, as summarised in Table 7-5. As all of the innovations were linked with the interventions, i.e. they were not expected to have occurred prior to the intervention date, the *'installed*

before [date of interventions]' was omitted. Based on anecdotal evidence regarding the discontinued use of current cost monitors, a category was also included that asked if it was 'already installed, but stopped using'. All the other categories were similar to the categories for WWDF and AHL innovations in Table 7-4.

Table 7-5: Indicators for innovation decision process for Visual innovations

Stage of Innovation-Decision process	Indicator
Knowledge (or pre-Knowledge)	Did not consider
Persuasion	Considered and still deciding
Decision	Planning to get (Adoption)
	Considered but decided against (Rejection)
Implementation	Have ordered it, waiting for installation
	Already installed, but stopped using (Rejection)
Implementation / Confirmation	Is installed or already did

The behavioural category was much different. Firstly, as many behavioural changes are very simple, small, every day actions which do not necessarily take as long to consider as technical innovations, it was deemed nearly impossible to gauge the innovation-decision stage of the respondent. Secondly, the measurement of change was done using two sets of questions that asked about the same behaviours. The final set of questions was the result of many iterations which were included in the pre-test (see section 7.2.3). Ultimately, the set of questions in Table 7-6 were posed. These questions were based on questions from the EST website (EST *Frequently asked questions*), and were refined after the pre-test (see Appendix C).

Table 7-6: Indicators of adoption for Behave innovations

Behave innovation questions
I switched off items on standby, if possible.
I boiled the kettle with only just enough water.
When it was cold at night, I drew the curtains.
I used heating controls (for example: timers & valves on radiators and thermostats).
I turned off lights when they were not needed.
I turned off electrical equipment (for example: computers) overnight when it wasn't being used.
I shut off heating in rooms that weren't used.

This set of questions was posed twice.[104] The first set of questions asked about behaviours in the last 7 days, and the second asked about behaviours before the point of intervention, with answer categories arranged in an item-in-a-series based on a 5-point Likert scale[105] which ranged from 'All the time' to 'Never'. Adoption was measured

[104] These questions were separated by other questions (i.e. they did not directly follow each other in the questionnaire). For question order, see final questionnaire in Appendix D.

[105] A Likert scale is "a widely used format developed by Rensis Likert for asking attitude questions. Respondents are typically asked their degree of agreement with a series of statements that together form a multiple-indicator or –item measure. The scale is deemed then to measure the intensity with which respondents feel about an issue" (Bryman 2008, p.695).

by examining changes between the 'before the intervention' and 'now' responses; this is further described in 8.3.6.

7.2.2.3 Name generator and interpreter

Operationalising mobilised 'energy social capital' involved identifying indicators for the following dimensions: 1) social network members who have already been approached and 2) social resources in the form of energy-related information. The responses would enable comparisons with the Energy Efficiency Resource Generator (Hypothesis 4) and self-reports of adoption status (Hypothesis 5).

Following the innovation-decision stage questions for each of the four innovation categories, the following question was posed:

> From time to time, people discuss matters with others to get information. Thinking about [the above innovations],[106] did you discuss these with anyone to get information since [date programme started]?

If the respondent ticked 'no' or 'don't know', they were asked to skip to the next section of innovations. If the respondent ticked 'yes', the following statement constituted the name generator, which was designed to elicit the names of three people per innovation category (Arndt 1967):

> Please list up to THREE (3) people with whom you discussed [the above innovation] to get information since [date programme started], filling in their first name (or initial) and surname initial, and answer the corresponding questions, ticking only one box for each (a, b & c).

The 'corresponding questions' were name interpreters which asked about the characteristics about the named information source. The first question addresses Hypothesis 5e, namely whether the information gained was positive or negative (answer categories were *in favour, neutral, not in favour* and *don't know*): *"Did this person seem in favour of [the set of innovations], or not?"* The next question was posed regarding the strength of tie (Hypothesis 5b), which was operationalised by asking: *"How do you know them?"* The answer categories were similar to the energy efficiency resource generator: 'immediate family,' 'wider family,' 'friend,' 'neighbour,' 'colleague,' and 'acquaintance.' A final question asked about the location of the named person, which addresses Hypothesis 5a: *"Do they live in [name of village/town]?"*[107]

[106] The type of innovations which the respondent had just answered were listed here.
[107] The latter question was separated from the strength of tie, as it would be possible for each person to live in the village. The answer categories were yes, no and don't know.

As four innovation categories were constructed, respondents could name a maximum of 12 different people (i.e. 4 innovation categories multiplied by 3 names for each innovation category), which would enable operationalisation of Hypothesis 5d regarding speaking to multiple people. However, in the total of 892 returns, there were no instances of a person naming twelve different people.

7.2.2.4 Homophily

There were additional name interpreter questions that were necessary to ascertain homophily (Hypothesis 5c) between the respondent and each named person. In order to avoid burdening respondents with a longer questionnaire, the homophily questions were placed towards the end of the questionnaire (in Section F of the final questionnaire, see Appendix D). The respondent was asked to "*re-write the initials of THREE (3) people who you spoke to the MOST about energy efficiency*". The four homophily concepts chosen were age, educational qualification, whether the person lived with a partner, and gender. The first question asked was: *"How old are they?"* Age groupings from the Office of National Statistics *Harmonised Concepts and Questions for Social Data Sources: Primary Standards* were used (ONS 2008a) as answer categories (Finch 1986).[108] The most aggregated age output categories are: 0-24, 25-44, 45-64, 65-74, and 75+ (ONS 2008a).[109] Though the categories are very wide, it was expected that respondents would be less likely to leave them blank, as they could at least make an educated guess. Bearing in mind the distinctions between sex and gender in constructing survey questions (Morgan 1986),[110] it was again decided to follow the ONS output categories for "gender": 'male' and 'female' (ONS 2008a). Therefore, the next question addressing the three named alters asked: *"Are they male or female?"* The third homophily question addressed marital or partnership status. A modified version of the recommended ONS measures related to living arrangement were utilised (ONS 2008a):[111] *"Are they married (or living as a couple)?"* The last homophily question on education asked: *"What educational qualification have*

[108] Questions on age can be posed which simply asks the respondent to respond by stating their actual age at their last birthday. However, it was expected that the respondent would not necessarily know the age, particularly if they were only acquaintances, but may at least have an idea of a broader age category. Therefore, broader answer categories were employed.

[109] It is not necessarily recommended by the UK Government that data be collected in these categories, rather, these are the aggregation categories suggested.

[110] There are many considerations in gender-related questions in surveys, such as sexuality, sexual division of labour, and concepts of masculinity and femininity. Therefore, "...the possibilities of using more subtle differentiations in terms of gender identification should at least be considered" (Morgan 1986 [online]).

[111] The ONS has two different sets of measurements which related to partnership status, which are "... appropriate for different purposes" (ONS 2008a, p.9). Legal partnership status has output categories of married, civil partnered, and not married or civil partnered. For the purposes here, however, it was decided that the living arrangements categories, i.e. living in a couple, or not living in a couple, were more appropriate. These were deemed more appropriate as it applies to the household and may influence household living arrangements, social network interactions, and ultimately energy use. However, there are still network studies which indicate that those either married or in couples exhibit certain qualities which distinguish them from unmarried or non-partnered people (Wellman & Wortley 1990; Johnson 2004).

they achieved?" The ONS output categories were used as answer categories: degree, or degree equivalent and above; other qualifications; no qualifications (ONS 2005).[112]

Equivalent questions on age, gender, marital / partnership status, and education were then asked of the respondent. Homophily was determined by comparing the answers of the alters with the respondent.

Further questions were included at the end of the questionnaire regarding accommodation, which did not directly pertain to the hypotheses and are explained in Appendix E.

7.2.3 Questionnaire Pre-test

Pre-testing is a method of investigating problems in a questionnaire prior to the full survey implementation. It generally involves evaluating procedures of survey administration; identifying mistakes in the printing, design or construction of the questionnaire; and learning if people understand the questions (Dillman 2000). Pre-tests often solicit the advice and feedback from "knowledgeable colleagues and analysts" (Dillman 2000, p.140) and can use interviews to understand cognitive qualities of the questionnaire content.[113]

The questionnaire was distributed to four different groups for the pre-test. The first group were professional colleagues or the researcher's personal contacts. The other three groups consisted of members of the community groups in North Leigh, St Athan and Alyth. The leader of each community group was contacted and asked if group members would consent to filling in the questionnaire and answering questions. They all consented, and questionnaires were distributed.[114] Each person was also asked additional, specific questions (see Appendix C) to elicit their feedback on the questionnaire (Hughes 2004).

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[112] Following tests to simplify categories of educational qualifications, the ONS states that: "The categories which the test suggested could be collected with adequate reliability and validity for broad classificatory purposes were: has degree or degree-level vocational qualification, or above; has a qualification below degree level; has no education or vocational qualifications" (ONS 2004, p.7).

[113] Pilot studies, in contrast, are administered to a sample of representative respondents, usually numbering 75 to 100 (de Vaus 2002a) or 100 to 200 (Dillman 2000), in the exact manner in which the full survey will be implemented. Pilot studies do not seek feedback on the questionnaire, but focus more on assessing and improving "response rates, item nonresponse, and variable distributions" (Dillman 2000, p.146). Due to the small numbers in the populations in North Leigh, St Athan and Alyth, it was decided that a pre-test would be conducted, but not a full pilot test.

[114] In North Leigh and St Athan, the author physically handed the envelopes containing the questionnaire, cover letter and return envelope to the individuals in the groups during a monthly meeting. In Alyth, due to time and cost limitations, the author posted the envelopes to the leader the group who distributed them at a monthly meeting.

Based on the feedback from the first three groups,[115] alterations were made and two versions were sent to the fourth group, varying in the layout and wording of the name generator and interpreters and order of the two sets of behavioural innovation questions (see Appendix C). Based on the pre-test and consultation with additional colleagues, changes were made and the final version of the questionnaire was determined.

7.2.4 Survey implementation

The method of survey implementation and data collection adhered to the general principles of the Tailored Design of the Total Design Method (Dillman 2000),[116] in order to achieve good response rates. The Total Design Method (TDM) has produced response rates of between 58% and 92% (Dillman 2000, p.27) using a final certified mail response, as explained in Appendix E, and between 50-70% in general household surveys (Dillman 1991). The general method relies on five points of contact with the potential respondent and use of an incentive (Dillman 2000). Multiple studies have been conducted on effective means to increase response rates and these two, i.e. multiple contacts and incentives, "have consistently been found to contribute significantly to higher response rates" (Brennan & Charbonneau 2009, p.369).

The TDM is based on five points of contact with the potential respondents. The first point of contact, a pre-notice letter, was sent to those identified in the sampling frame, i.e. approximately 1,450 people. The letter contained a brief explanation of the questionnaire and was accompanied by a pamphlet giving further explanation and contact details. One week later, the second point of contact included a mailing of the questionnaire, in addition to a cover letter, a return envelope (addressed and stamped), an incentive of a book of six 1st class stamps (Simmons & Wilmot 2004; Moody 2008), and a postcard asking if the respondent would be willing to participate in further research (which established the sampling frame for the qualitative research). The third point of contact was a reminder and thank you postcard which was sent 10 days later. The final fourth point of contact was made with non-respondents four weeks after the initial questionnaire was sent and included a replacement questionnaire, a cover letter and a return envelope (addressed and stamped). Though the TDM indicates that a fifth point of contact should be made through certified or registered mail (Dillman 2000), it

[115] The first group of colleagues and contacts, and the two groups in North Leigh and St Athan were all contacted between December 2008 and February 2009. The group in Alyth were sent the questionnaires in March 2009.

[116] The Total Design Method (TDM) was developed by Don Dillman in 1972. The Tailored Design responds to changes in "technologies, theoretical advancements, mixed-mode considerations, a better understanding of specific survey requirements, and an improved base of social science knowledge" (Dillman 2000, p.6), but is still based on the original principles of the TDM, which is described in more detail in Appendix E.

was deemed too expensive and was not included. A full explanation of the implementation of the Total Design Method is found in Appendix E and examples of the items which were enclosed in all of the mailings are found in Appendix F.

The multiple mailing and use of an incentive appear to have achieved the response rates that Dillman (1991; 2000) indicates are expected: 62.4% in North Leigh; 56.4% in St Athan; and 61.3% in Alyth. Almost forty people, across all communities, wrote a note of thanks regarding the stamps.[117]

7.2.5 Issues of concern

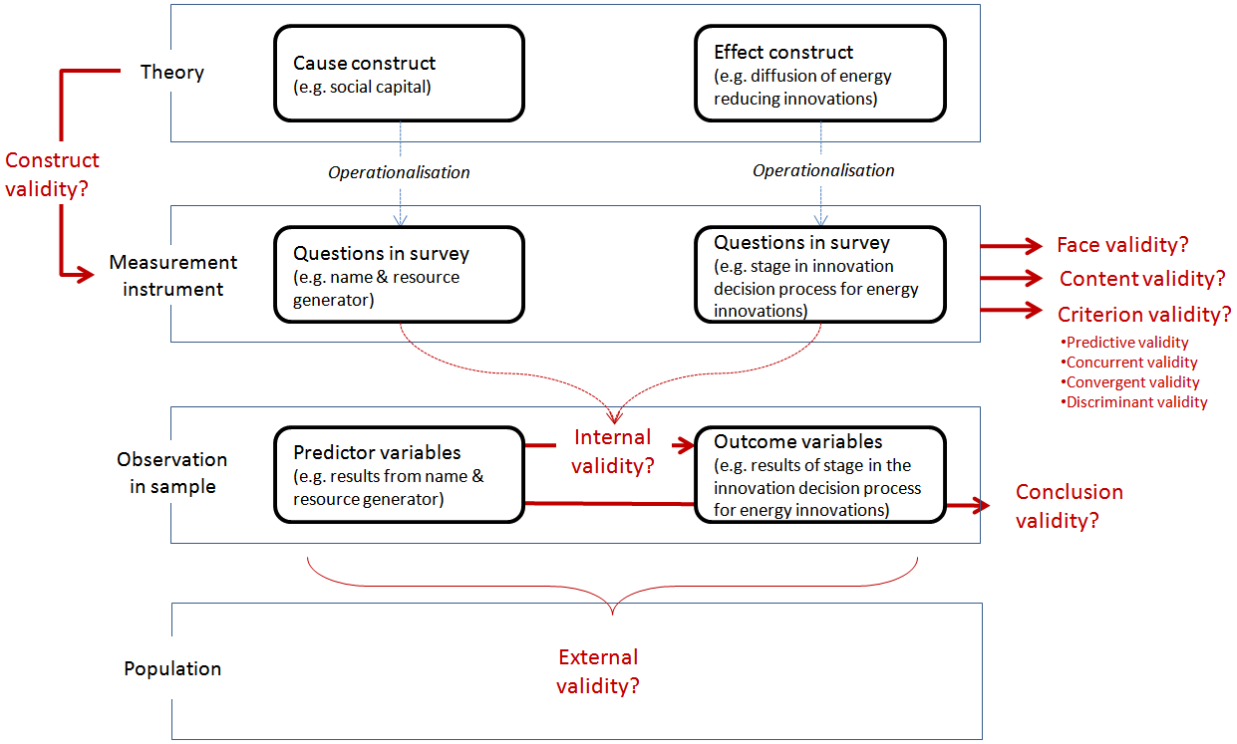
There are several issues of concern to address regarding error. Total survey error involves all the errors which can result from the measurement instrument and sample (Groves et al. 2004), and involves: validity, reliability, coverage error, sampling error and non-response error (Groves et al. 2004). Coverage error, sampling error and external validity were discussed in section 7.2.1. Issues of validity and reliability were also discussed in Chapter 6, and are only briefly addressed here, in addition to issues of respondent recollection (i.e. recall) and social desirability (i.e. offering socially desirable, or acceptable, answers).

7.2.5.1 Validity

As described in Chapter 6, there are generally three types of validity which need to be addressed in social research: construct validity, internal validity and external validity. There is a fourth to consider when conducting statistical tests which is known as conclusion validity (see Figure 7-2).

[117] Curiously many of them returned the stamps, either because the respondents thought they, themselves, had not been of much use, or they thought the researcher (a student) would have more use for them than the recipient, and in one case because the recipient thought it was a mistake that they had been included with the questionnaire.

Figure 7-2: Types of validity



Construct validity is "the extent to which the measure is related to the underlying construct" (Groves et al 2004, p.50). Construct validity is a broad concept which covers many different types of underlying constructs and evaluates the measurement of the concepts. According to Trochim (2006), construct validity is composed of, and measured with, six types of more specific forms of validity, the most important of which for the research here are face validity and content validity.[118] Face validity is determined by an instrument "measure[ing] what it is expected to measure" (Sarantakos 2005, p.84). This is largely determined by judgements from the research community, as there are "no common standards and principles" for evaluating face validity (Sarantakos 2005, p.84). Here, an attempt at achieving face validity was made by using established theories of diffusion of innovations and social capital, as well as established measurement instruments, particularly for the operationalisation of

[118] Criterion-related validity is "a prediction about how the operationalization will *perform* based on our theory of the construct" (Trochim 2006 [online]). Predictive validity assesses "the operationalization's *ability to predict something it should theoretically be able to predict*" (Trochim 2006 [online]). A high correlation between a predictor variable and an outcome variable would be an example of high predictive validity. Concurrent validity assesses "the operationalization's *ability to distinguish between groups that it should theoretically be able to distinguish between*" (Trochim 2006 [online]). For example, being able to distinguish between adopters and non-adopters of energy-reducing innovations, would be a means of verifying concurrent validity. This can be more thoroughly completed if the same measurement of the two groups is tested in more than one population, as it is here in the three villages. Convergent validity is "the degree to which the operationalization is similar to (converges on) other operationalizations that it theoretically should be similar to" (Trochim 2006 [online]). This usually involves evaluating multiple measurements of a concept through correlational measures. The only instance where this is applicable in the current research is for the behavioural innovations, which were measured using Cronbach's alpha (see Appendix J). Discriminant validity "is based on the argument that two different concepts should not correlate with one another" (de Vaus 2002b, p.30), which is not directly applicable to this research.

mobilised social capital. Content validity "refers to how much a measure covers the range of meanings included within a concept" (Babbie 2001, p.144). Social capital can convey many meanings, depending on how it is defined. This is a difficult type of validity to judge, but again, the adherence to established theory and established measurement instruments for 'individual social capital' is meant to increase the level of content validity.

Internal validity "refers to the extent to which the research design impacts on the research outcomes" (Sarantakos 2005, p.85) to ensure that one variable (X) is truly related to an outcome variable (Y), and not another variable. Internal validity checks were conducted after the data was collected using statistical controls (de Vaus 2001; Sarantakos 2005), as described in Chapter 8, and through the mixed methods research design of complementarity (Greene et al. 1989).

Conclusion validity asks if "the relationships between hypothesized independent and dependent variables [are] statistically significant" (Abowitz & Toole 2010, p.109). Good statistical power increases the conclusion validity. Most inferential statistical tests[119] were performed on the resulting quantitative data using SPSS 17, though some were performed using Excel, and are described in full detail in Chapter 8. As well, descriptive statistics are described in Chapter 8 which are useful for explaining and comparing results.

External validity involves the ability to generalise to a wider population. Though probability sampling was not used here, statistical methods and replicability across cases is meant to address issues of external validity.

7.2.5.2 Recall & social desirability

Though not generally included in the discussions of general measurement validity, there are several other factors which can create bias and affect validity in questionnaires, including recall and social desirability.

The structure of the questionnaire relies on the ability for a respondent to fairly accurately recall not only the technical and behavioural changes which are made regarding energy use, but also the names of people with whom the respondent spoke to about these innovations. The literature indicates that respondents can forget

[119] Inferential statistics were used in order to generalise to the population of each community, as it was not possible to conduct a complete census of each population. The purpose of inferential statistics is to infer the probability of finding the same result in the whole population (Healey 2002). If a whole population (census) had been sampled, it would not have been appropriate to report inferential statistics.

between 6-26% of intimate relations (i.e. close friends, sex partners and drug-use partners) (Brewer & Webster 1999; Bell et al. 2007), with levels of forgetting increasing the further respondents are asked to think further back in time (Schwarz & Oyserman 2001). Regarding innovations, Katz et al. (1963) hypothesised that, "One can perhaps ask about the date of purchase of major appliances, but it is almost impossible to rely on recall for most other things" (p.242), though this was not based on experimental data. The questionnaire designed here was sent to residents almost two years after the intervention programmes began in each community. The anticipated length in the diffusion of innovations, and the time-staggered deployment of the innovations, necessitated that some time pass before sending the questionnaires. Higher recall may have resulted in sending questionnaires a year after the interventions, for example, but even at that point smart meters were still being installed by SSE due to delays at the beginning of the programme. As well, other logistical limitations prevented the research from occurring any earlier.[120] However, at the time of the focus groups, which were conducted after the questionnaires were distributed, it appeared that information was still being diffused, which means the timing may have been appropriate.

Social desirability is "the tendency on behalf of the subjects to deny socially undesirable traits and to claim socially desirable ones, and the tendency to say things which place the speaker in a favourable light" (Nederhof 1985, p.264). However, the data collection mode of self-completion questionnaire is actually meant to reduce social desirability, as the respondent does not have to give their answer to a physically-present person (Nederhof 1985). It is anticipated that respondents may still have wanted to appear to be more energy efficient than they really are, but the data collection mode and assurance of confidentiality were intended to minimise this bias.

7.2.5.3 Reliability

Reliability involves the consistency and repeatability of results. Reliability was addressed before full survey implementation by employing the use of a pre-test which verified the cognition of the questions and helped to refine some questions, wording and layout. Reliability can also be estimated through measures of internal consistency.[121] There are several measures for obtaining internal consistency,[122] but for

[120] Amongst other things, the researcher transferred universities, which not only took a few months for transfer of registration, but had the further impact of delaying obtainment of ethics committee approval, without which the research could not have proceeded.

[121] There are generally four methods for testing reliability: test-retest method; panel-of-judges method; parallel-forms method; internal consistency methods. The test-retest reliability method involves administering the same questionnaire to the same sample on two different occasions (de Vaus 2002b). This was not possible in the research presented here, due to financial and time constraints. The panel-of-judges reliability method involves more than one person independently recording and coding the data (de Vaus 2002b; Trochim 2006). This was not possible in the research presented here, as there was only one researcher and hundreds of questionnaire returns. The parallel-forms method involves administering "two

the purposes here, Cronbach's alpha coefficient (α) was used to measure multiple response categories for behavioural variables, and a reliability test (ρ) was determined for the Energy Efficiency Resource Generator (both are explained in Appendix J).

7.2.5.4 Error

There are several types of error to consider in social research, including coverage error and sampling error, both of which were discussed in section 7.3.1. Others include measurement error and non-response error.

Measurement error, of which there are two types (random and systematic) is "error that occurs when the recoded or observed value is different from the true value of the variable" (Alwin 2007, p.3). Random error occurs "when factors ... randomly affect measurement of the variable across the sample" (Trochim 2006 [website]). Systematic (or non-random) error "occurs where there is the same error for every case" (de Vaus 2001, p.31) due to some condition which might affect every respondent of the survey. Systematic error results in bias and can affect the reliability of measurement (Trochim 2006). The pre-test of the questionnaire identified unambiguous wording, and changes were made to reduce any associated measurement error.

Non-response error results from "the fact that some of the members of the sample population do not respond to the survey questions" (Dillman 1991, p.228). Non-response error is generally measured by response rates. The research presented here used a method of survey implementation (i.e. TDM) which was meant to increase response rates and thus reduce non-response error (see Appendix E).

7.3 Qualitative research

Having discussed the sampling method, design, content, implementation and issues of concern regarding the quantitative research, which forms the primary investigation into the research questions and hypotheses, this section examines similar issues in the qualitative research. As Rogers (2003) quotes:

> "Katz (1961) remarked, "It is as unthinkable to study diffusion without some knowledge of the social structures in which potential adopters are located as it is to study blood circulation without adequate knowledge of the veins and arteries" (p.25).

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different but equivalent measures on ... one occasion" (de Vaus 2002b, p.19). Again, time constraints prevented a full use of this method.

[122] Internal consistency measurement methods also include: average inter-item correlation; average item-total correlation; split-half reliability (de Vaus 2002b; Trochim 2006).

The reason for conducting qualitative research is to understand more about the social structures of the communities, putting the quantitative findings into context. These findings are thus meant as a complement to the primary quantitative findings.

This section begins by describing the sampling method and continues by describing the focus group design and methods of analysis. Finally, issues of concern are addressed which parallel the issues addressed in 7.2.5, but are tailored for qualitative research.

7.3.1 Sampling method

As stated in 7.2.1, choosing a sample involves determining the population, establishing a sampling frame, and deciding on the sample size, if appropriate, and sampling method (Bryman 2008; de Vaus 2002a). These issues are addressed, but in a slightly different order, owing to the nature of the qualitative research. Firstly, as stated, the purpose of the qualitative interviews was to investigate the context of each case (i.e. community), enhancing the quantitative findings. There are thus three populations: each of the three communities. In order to understand the embedded units of analysis, i.e. the householders, it was decided that it would be most useful to interview members living in the community via focus groups. It was decided to approach two groups of people: 1) those involved in the local group promoting energy efficiency, and 2) residents of the communities who were not involved in the organising group.

7.3.1.1 Local organising groups

As previous contact had been made between the researcher and the local groups, these groups became a convenience sample, i.e. “a sample that is selected because of its availability to the researcher” (Bryman 2008, p.692). In all cases, an invitation to participate in the focus group was sent to the leader or organiser of each local organising group, who then sent the invitation on to the other group members. Therefore, the number of people involved in each group could not be anticipated until the focus group was actually conducted, as explained in Table 7-7.

Table 7-7: Qualitative sampling frame for local organising groups

Name of community	Name of community group and/or initiative	Qualitative sampling frame
North Leigh	Challenge North Leigh	Unknown
St Athan	Get Smart with St Athan	Unknown
Alyth	Alyth Energy Challenge	Unknown

7.3.1.2 Local residents

For the second groups, i.e. local residents, the respondents of the questionnaire became the sampling frame. As mentioned in section 7.2.4, the second point of

contact included a postcard which asked potential respondents if they would be willing to take part in further research. Respondents were asked to supply their contact details and return the postcard with the questionnaire, if they were willing to do so. This constitutes a form of purposive sample. Purposively sampling is a type of non-probability sampling, meaning participants are not selected randomly (Bryman 2008). In purposive sampling, participants "are selected because of their relevance to understanding a social phenomenon" (Bryman 2008, p.415) and "entails an attempt to establish a good correspondence between research questions and sampling" (Bryman 2008, p.458). In mixed methods research, it is not uncommon to use the results of a quantitative survey as the basis for a purposive sample for the qualitative research (Sempik et al. 2006; Bryman 2008; Bryman et al. 2008). Table 7-8 indicates the number of returned postcards received from each community.

Table 7-8: Qualitative sampling frame for local resident focus groups

Name of community	Population (Total number of dwellings)	Quantitative sampling frame (i.e. matched names & addresses)	Total number questionnaires returned	Qualitative sampling frame (i.e. returned postcards)
North Leigh	800	364	227	49
St Athan	543	330	186	24
Alyth	1130	782	479	97

In North Leigh, 21.6% of those who returned a questionnaire also returned a postcard. In St Athan it was 12.9% and in Alyth it was 20.3%. A full list, i.e. the sample frame, was made of all those who returned the postcard, which was supplemented with details in the questionnaire (respondent age, gender, rates of adoption, written comments, and indications of mobilising social capital). There were no firm rules which the author employed for choosing participants from the sampling frame list, but a general attempt was made to try to select a variety of ages and equal numbers of males and females; after this, the other criteria were considered.

Focus groups typically consist of between 6-10 people (Bryman 2008; Peek & Fothergill 2007), but it is not uncommon to have groups of between 4-6 people (Peek & Fothergill 2007). In order to achieve these numbers, invitations were sent to at least twice as many people as were expected within the 4-6 range.[123] In every case, it was anticipated that there would not be enough participants, after the initial invitations were

[123] The invitations included: a cover letter; a pamphlet similar to that sent in the first point of contact, reminding them of the research; and a stamped return postcard to reply. The cover letter and pamphlet were meant to remind recipients of the questionnaire and the postcard which the recipient had returned, and requested their presence at a focus group at a locally-accessible venue in the community. The postcard included tick boxes to either confirm attendance or decline. A further thank you reminder was sent by postcard (or email) a few days prior to the focus group.

sent. Therefore, a second wave of invitations was sent to other people from the sampling frame.[124] Table 7-9 summarises the sample.[125]

Table 7-9: Summary of confirmations for residents focus groups

Community	Number send invitations (first wave)	Number send invitations (second wave)	Number confirmed
North Leigh (Group 1)	8	7	4
North Leigh (Group 2)	8	6	3
North Leigh (Group 3)	8	3	4
St Athan	12	6	4
Alyth	11	7	6

The focus group recruitment was an iterative process, and changes were made as lessons were learned. For example, there was initially an attempt to have three focus groups of local residents in each village. The general findings from North Leigh focus groups and the logistics did not seem to justify the need to do more than one focus group of local residents. Therefore, in Alyth and St Athan, there was only one focus group organised for local residents (and one for local organising groups).

7.3.2 Focus group design

Focus groups are:

> "a form of group interview in which: there are several participants (in addition to the moderator/facilitator); there is an emphasis in the questioning on a particular fairly tightly defined topic; and the accent is upon interaction within the group and the joint construction of meaning" (Bryman 2008, p.474).

The seminal work on focus groups is most often attributed to Robert Merton and his work on 'the focussed interview' in the 1940s (Merton & Kendall 1946), though they did not become popular amongst social scientists until the late 1980s (Peek & Fothergill 2007). The focused interview, which Merton & Kendall (1946) explain can be used in either individual interviews or groups, emphasises "studying and learning about a 'particular concrete situation'" which is "relatively singular in focus" (Stewart et al. (eds.) 2007, p.9). The purpose of focus groups is to gather a depth of understanding for a given subject, which makes its use in determining context for cases very appealing. They are useful for obtaining more data more quickly than single interviews. As respondents are able to interact with each other, the "synergistic effect" allows more subjects and differences of opinion to emerge (Stewart et al. (eds.) 2007, p.43). A limitation of focus groups is that the results emerging from small numbers of people,

[124] Those in the first wave of invitations, and most of the subsequent waves of invitations, were sent postal invitations. A few recipients were also invited by electronic mail in the subsequent waves, but only if the recipient had provided this as a means of communication, and to save time. In addition, a postal strike occurring during the first focus group made email preferable.

[125] It should be noted that the number confirmed in Table 7-9 is not actually the final attendee number, as some dropped out and often partners of respondents attending without confirming in advance.

and their interactions with a select few others, cannot necessarily be generalised to the larger population (Dawson et al. 1993) and bias may result from presence of a researcher (Stewart et al. (eds.) 2007).

An interview guide was devised to address the research questions (Stewart et al. (eds.) 2007). Questions were developed which focused on the sources of energy efficiency information and the nature of 'word-of-mouth' information, or the people with whom respondents mobilised energy social capital. Two interview guides were created, one for the local organising groups which contained nine questions, and one for the residents groups, which contained eleven questions, adhering to recommendations of using less than twelve questions (Stewart et al. (eds.) 2007; Krueger & Casey 2009). Based on the number of questions, an estimate was made that the expected length of each focus group would be approximately forty-five minutes, which is a bit less than the average recommended one hour (Dawson et al. 1993) to two hour (Dawson et al. 1993; Krueger & Casey 2009) focus group. The final result in the research here was that the shortest group was about twenty-nine minutes, the longest was one hour and thirty-eight minutes, and the average across all eight focus groups was approximately fifty minutes.

The questioning guides, which are in Appendix G, contained both prompts to the facilitator (i.e. the author of this research) and the questions to ask the respondents. Following the introduction, an opening question was devised which everyone could answer, asking those in the group to give their name and to state the length of time they had lived in the given community (Krueger & Casey 2009). An introductory question asked about awareness of the efforts of the local group, or how long they had been involved with the group. This was followed by a transition question which asked if the programme had made the respondents think about energy efficiency in their home to a greater extent. Then key questions posed regarding: asking about information on energy efficiency; general conversations about energy efficiency; and the uniqueness of the village (Krueger & Casey 2009). A final question for the residents was posed asking what they would recommend, as far as communication methods, to those groups promoting energy efficiency programmes.

All of the focus groups were recorded with a digital voice recorder and subsequently transcribed by a third party organisation.[126] Each focus group took place in a local community centre of the given village or town. The venues were identified with help from the local organising group leaders and chosen for ease of access for local

[126] Global Transcription Services, http://www.global-transcription-services.co.uk/

residents, most of whom would be able to walk to the venue. The dates and times were also recommended by the group leaders.

7.3.3 Qualitative strategy and method of analysis

There are several types of strategies for approaching qualitative analysis. Two of the main approaches are grounded theory and analytic induction (Bryman 2008). Each acts as a framework for the method of data analysis (Bryman 2008). Grounded theory derives meaning and hypotheses from the collected data (Bryman 2008). Glaser & Strauss (1967) indicate that grounded theory involves "...generating theory [in] a way of arriving at theory suited to its supposed uses" (p.3). As the research presented here is based on hypotheses which have been derived *a priori*, grounded theory would not be appropriate. Analytic induction, with its emphasis on testing hypotheses, was more suitable. Analytic induction is:

> "an approach to the analysis of data in which the researcher seeks universal explanations of phenomena by pursuing the collection of data until no cases that are inconsistent with a hypothetical explanation (deviant or negative cases) of a phenomenon are found" (Bryman 2008, p.539).

Analytic induction begins with a research question and hypothesis before beginning the data collection. Analytic induction "can provide a bridge between logico-deductive research focused on hypothesis testing and the more interpretive approaches represented by various types of qualitative research" (Gilgun 1994, p.2). Robinson (1951) explains that analytic induction begins with a general definition of the phenomena which is under examination and develops hypotheses of the phenomena. The next step is then to examine one case and make a judgement as to the fit of the hypotheses to that case. If the hypotheses do not explain the phenomena, the hypotheses are reformulated to fit the case. Further cases are then examined to understand if the reformulated hypotheses fit. This procedure is continued until a "universal relationship is established" (Robinson 1951, p.813).

There are many ways to analyse qualitative data including, but not limited to, qualitative content analysis, narrative analysis, thematic analysis, discourse analysis and analysis of semiotics (Bryman 2008).[127] Qualitative content analysis is:

> "An approach to documents that emphasizes the role of the investigator in the construction of ... meaning .... There is an emphasis on allowing categories to

[127] Narrative analysis is "an approach the elicitation and analysis of data that is sensitive to the sense of temporal sequence that people ... detect in their lives and surrounding episodes and inject into their accounts" (Bryman 2008, p.696. Thematic analysis refers to "the extraction of key themes in one's data" (Byrman 2008, p.700). Discourse analysis "emphasizes the ways in which versions of reality are accomplished through language" (Bryman 2008, p.693). Semiotics is the study of signs, and in qualitative research is meant to "uncover the processes of meaning production and ... the effect upon actual and prospective consumers of those signs" (Bryman 2008, p.699).

> emerge out of data and on recognizing the significance for understanding the meaning of the context in which an item being analysed (and the categories derived from it) appeared" (Bryman 2008, p.697).

Krippendorf (2004) indicates that the intent of content analysis, which he refers to as a "research technique," is to make "replicable and valid inferences from texts ... to the context of their use" (p.18). Content analysis has the advantage of being flexible, as it can be applied to many types of qualitative data. It also eases transparency of method and facilitates further replications (Bryman 2008). Disadvantages include the fact that data are only as good as that which is collected or provided, and necessary interpretation is needed by the research in devising coding protocols and understanding latent variables (Bryman 2008).

There are a number of steps to undertake when structuring the process of content analysis. The critical starting point is what Stewart et al. (eds.) (2007) refer to as "unitizing" (p.120), or determining the unit of analysis, e.g. the entity that is being derived from the 'content'. A unit can be a word, "a sentence, a sequence of sentences, or a complete dialogue about a particular topic" (Stewart et al. (eds.) 2007, p.120).[128] Statements were used as the unit of analysis, either in the form of partial sentences, full sentences or paragraphs from the transcripts. Another step in structuring content is the "data-making process" (Stewart et al. (eds.) 2007, p.123). This generally involves creating categories and guidelines; units of analysis are then designated to those categories. Bryman (2008) refers to this as coding. Data was initially coded here using Nvivo 7 (QSR International 2006). A coding schedule, or "a form onto which all the data relating to an item being coded will be entered" (Bryman 2008, p.283), was developed based on the focus group script, which was itself based on the research questions in Chapter 5. Nvivo 7 was used for creating the coding schedule and coding the transcriptions, and Microsoft Office PowerPoint (Microsoft Corporation 2007) was used to produce models of the nodes.[129] Two models were produced for each village: one for the organising group, and one for the local residents. In the case of North Leigh, this meant that three focus groups were used to create one model. The models consisted of grouped topics that were based on the focus group questioning guide, but also included topics that emerged during the focus groups. Bullet point statements then summarised the specific findings in each of the groupings. All six models, which reflect the coding schedule created in Nvivo 7, are presented in Chapter 8.

[128] A unit could also be significant actors, words, subjects and themes, or dispositions (Bryman 2008).
[129] Nvivo 7 has a function through which models can be created, inserting the coded data and displaying appropriate links (Richards 2006), but PowerPoint was chosen due to the fact that nodes did not need to be linked and its ease of use.

In order to address the context of the specific hypotheses, the statements which had been coded in Nvivo 7 were extracted and placed alongside appropriate hypotheses. This resulted in six hypothesis-matching tables, as in Appendix G. These statements were then used in the complementarity mixed methods analysis of the hypotheses, as is discussed in Chapter 6.

7.3.4 Issues of concern

Error and bias of quantitative methods was discussed in terms of validity, reliability and other error measurements. There are several methods and "tactics" (Sarantakos 2005, p.87) of achieving validity and reliability in qualitative research, several of which adhere to the quantitative equivalents (Sarantakos 2005; Bryman 2008). Many qualitative researchers, however, use a different philosophical perspective to approach these issues of concern (Trochim 2006). Guba & Lincoln (1989) posit that the evaluation of qualitative data should follow a constructivist ontological approach, rather than the objectivist ontological and positivist epistemological approach of quantitative research. Guba & Lincoln's (1989) quality evaluation criteria consist of four quality criteria of methods and are summarised in , along with the quantitative quality measures which they parallel.[130]

Table 7-10: Guba & Lincoln's (1989) quality criteria measures (from Trochim 2006)[131]

Traditional criteria for judging quantitative research	Alternative criteria for judging qualitative research
Internal validity	Credibility
External validity	Transferability
Reliability	Dependability
Objectivity	Confirmability

Credibility involves:

> "ensuring that research is carried out according to the canons of good practice *and* submitting research findings to the members of the social world who were studies for confirmation that the investigator has correctly understood that social world" (Bryman 2008, p.377).

This credibility, or internal validity, was addressed during the focus groups when issues would arise that perhaps were unknown to the researcher, and brief questions were asked for clarification and to understand if it was an individual or group finding, i.e.

[130] Guba &Lincoln's (1989) quality evaluation criteria consist of four 'trustworthiness' (or parallel) criteria which "are primarily methodological criteria" (p.245). They also devised 'authenticity' criteria which "suffers from being implicit to the process, and hence is not very persuasive to those who wish to see explicit evidence" (p.245). These include: fairness, ontological authenticity, educative authenticity, catalytic authenticity and tactical authenticity. It is largely felt by the researcher that these issues are addressed elsewhere in the research presented here.

[131] Permission to reproduce this table has been granted by Prof. William M.K. Trochim, Cornell University.

others were asked the same thing, if appropriate (Guba & Lincoln 1989). As well, the data were recorded and subsequent assumptions were checked against recordings and findings discussed with peers. Transferability refers to the generalisability of the findings, "provid[ing] an extensive and careful description of the time, the place, the context, the culture" (Guba & Lincoln 1989, p.241-242). The generalisability of the focus group findings here was determined by comparing findings between groups in the same communities, as well as between communities. Dependability, in parallel with reliability, is "concerned with the stability of the data over time" (Guba & Lincoln 1989, p.242).[132] The findings from the three villages, which are presented in a parallel manner, were used as a dependability check. Finally, confirmability is meant to ensure that findings are "not simply figments of the evaluator's imagination" (Guba & Lincoln 1989, p.243). The confirmability is available by inspection of the findings of the maps and hypothesis quotes with the transcriptions in Appendix G from which they were derived.

7.4 Combining quantitative and qualitative research

As was established in Chapter 6, a mixed method approach has been chosen according to a justification of complementarity, which "seeks elaboration, enhancement, illustration, clarification of the results from one method with the results from another" (Greene et al. 1989, p.259). The findings from the statistical analyses will be presented for each of the three villages, and evaluations will be contextualised from the findings of the focus groups. All three villages will then be compared to each other, in order to test the validity and reliability of findings and also to understand why different findings may emerge.

7.5 Ethics

Primary source social research necessarily involves some form of contact and interaction with the people being studied, i.e. the potential respondents, which require ethical considerations. As Diener & Crandall (1978) indicate, there are four main areas of concern regarding ethics in social and behavioural research: whether the research results in harm to the participants; whether the participants have given informed consent; whether the research involves an invasion of privacy; and whether there is deception involved (BSA 2002). Each of these issues was addressed, as is summarised in Appendix H and is evidenced through registration with the UCL Data Protection Officer and obtainment of a Data Protection number; the completion of a

[132] Guba & Lincoln (1989) suggest a "dependability audit" of "documenting the logic of process and method decisions" (p.242). Bryman (2008) indicates that the audit is not very popular in qualitative research, but is occasionally used. Though the process of the focus groups was largely recorded for the research here, an audit was not considered.

formal risk assessment; and permission granted to the author by the UCL Ethics Committee.

7.6 Conclusion

The quantitative and qualitative methods illustrated in this chapter explain the systematic approach to data collection which was undertaken. The quantitative research is largely based on established techniques and meant to directly address the research questions and hypotheses. The Energy Efficiency Resource Generator (EERG) was designed specifically for the research conducted here. The construction of the EERG is based on established resource generators (van der Gaag & Snijders 2005; Webber & Huxley 2007), but the focus on energy efficiency is new. The self-completion questionnaire was implemented based on the Total Design Method (Dillman 2000) in order to achieve higher response rates and reduce error. The qualitative findings are meant to complement and contextualise the quantitative findings. The qualitative method of focus groups was based on established design features which involved the recruitment of between 4-6 people per group (Peek & Fothergill 2007), employed a question guide (Stewart et al. (eds.) 2007; Krueger & Casey 2009) and also addressed aspects of the research questions, while emphasising broader related elements, such as 'uniqueness' of each community. Bearing in mind issues of error and reliability, the quantitative and qualitative findings are analysed in Chapter 8.

Chapter 8: RESULTS & DISCUSSION

8.1 Introduction

This chapter presents the findings of the three case studies and discusses the implications of those findings. In order to put the findings in context, the chapter begins by describing the context of three case communities. This first section summarises the events that have occurred in each community regarding energy efficiency and also summarises general findings from the focus groups. This is followed by the quantitative findings resulting from the self-completion questionnaires. These findings are complemented and supported by the qualitative findings, in the form of focus group member statements. The conclusions for each hypothesis are specific to the research populations, but can act to justify further research of social capital in the diffusion of energy-reducing innovations. The chapter concludes by stating the limitations experienced in the research process, as well as how they may affect the findings, and the implications for further research.

8.2 Community context

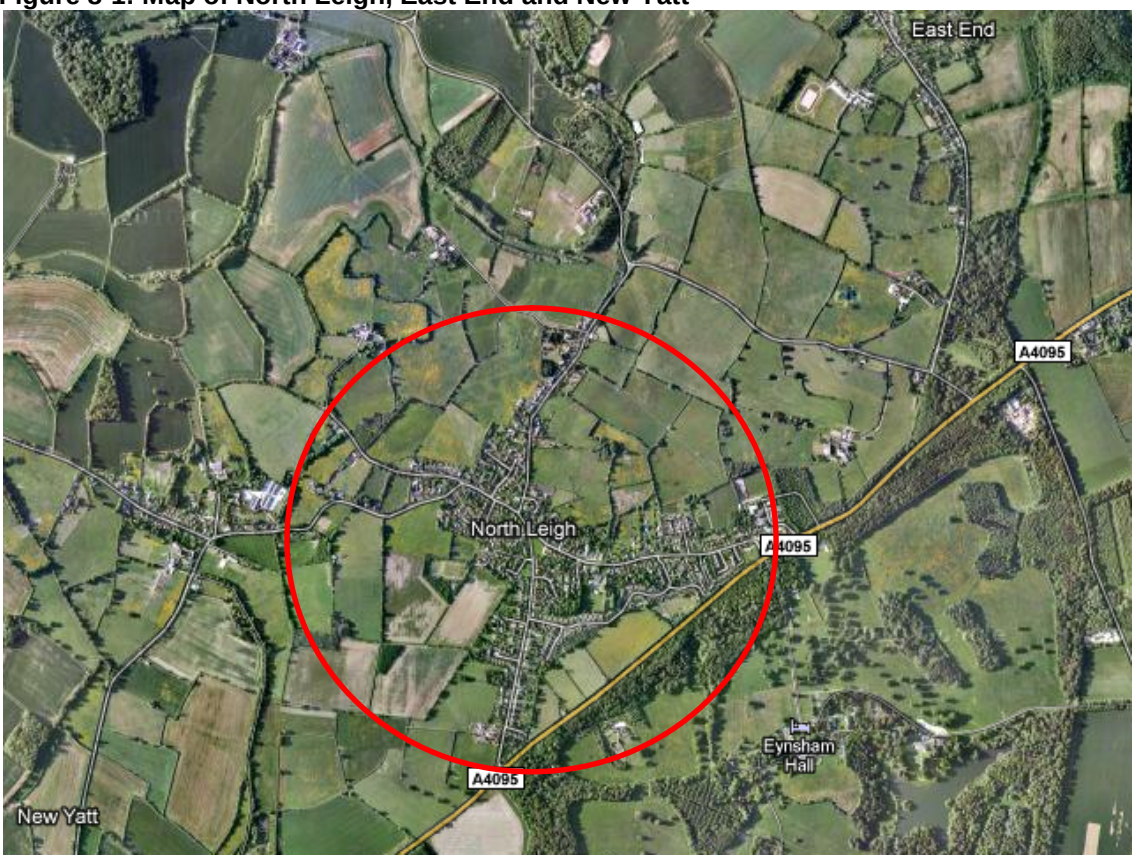
This section describes the events that occurred in each community, both before and during the SSE energy efficiency interventions. In describing the communities, a sense of the degree of community social cohesiveness and local environment emerges. The material in this section is derived from accounts arising from the focus groups, in addition to input from SSE and the author's experience in the communities. The qualitative research was conducted with a very limited number of people within each community, so the findings cannot be considered to represent the whole population of each community (Dawson et al. 1993). However, this caveat in place, the findings are expected to reflect at least a partial representation of each community for the purpose of understanding the case (i.e. quantitative) findings in a more holistic manner.

8.2.1 North Leigh

North Leigh is a village located in rural West Oxfordshire, England which is composed of approximately 800 households. North Leigh is generally discussed simply in terms of 'North Leigh', but is understood to include two other areas, known as East End (to the northeast) and New Yatt (to the southwest), as indicated in Figure 8-1. The village has a relatively new Memorial Hall that contains a community hall, a post office, a convenience shop and a local library. North Leigh also has a primary school, a small industrial estate (TVEC 2007a) and three churches. There are two pubs in North Leigh and a local paper called the Nor'Lye News. There are local buses, and a rail station in

the neighbouring village of Long Hanborough. The closest town in Witney, Oxfordshire, and the nearest city is Oxford.

Figure 8-1: Map of North Leigh, East End and New Yatt[133]



8.2.1.1 Energy efficiency in North Leigh

Prior to the Scottish and Southern Energy plc (SSE) intervention, North Leigh had been active in promoting energy efficiency. In 2005, a local group called the North Leigh Energy Efficiency Project promoted energy efficiency to householders, posing the question: "Could we make North Leigh Oxfordshire's Leading Energy Efficient Village?" (Challenge North Leigh 2009). The group was composed of local community members, working collaboratively with Thames Valley Energy Centre (TVEC),[134] an energy efficiency advice centre partially funded by the Energy Saving Trust. The aim of this project was to save energy and decide if an energy label, similar to the European Union energy label for low-energy lighting and appliances (European Union 1992),[135] could be applied to the village (Hamilton, *ClimateX: North Leigh Energy Efficient Village*). Having obtained funds from Oxford University's Environmental Change

[133] Image from Google Maps UK (http://www.maps.google.co.uk/), © 2011 Google – Map data © 2011 Google, Tele Atlas

[134] Energy efficiency advice centres were restructured in 2008 and this group had to re-bid for funding. TVEC was successful and is now called United Sustainable Energy Agency (Hamilton, *ClimateX: North Leigh Energy Efficient Village*).

[135] The European Union energy label rates devices based on standard measures of energy consumption for a product, with the rating scale ranging from G (least efficient) to A (most efficient), though has been revised to include higher efficiency ratings of A+ and A++ (http://www.energy.eu/focus/energy-label.php).

Institute, a feasibility study was conducted, supported by TVEC, West Oxfordshire County Council and the Energy Saving Trust, in order to establish the aim and method for achieving the goal of an energy label for the village (Challenge North Leigh 2009). For two years, between June 2006 and June 2008, quarterly gas and electricity meter readings were collected from volunteer householders by TVEC via postcards (Hamilton, *ClimateX: North Leigh Energy Efficient Village*). The first year provided a baseline and the second year people were encouraged to reduce their energy consumption. Based on meter readings from 86 households between June 2006 and June 2007, it was concluded that North Leigh's energy consumption was approximately 12% higher than the average that would be expected for a village of similar housing composition (TVEC 2007b). One year later, North Leigh managed to save 8% electricity and 7% domestic gas, adjusting for temperatures (Challenge North Leigh 2009). The Challenge North Leigh (Challenge North Leigh 2009) and ClimateX (Hamilton, *ClimateX: North Leigh Energy Efficient Village*) websites state that the efforts of North Leigh attracted the attention of SSE (which is branded Southern Electric in the south of England), and imply that the community trial was an extension of the initial energy efficiency project.

8.2.1.2 SSE community trial in North Leigh

In addition to the established local efforts on energy efficiency, the large customer base made North Leigh an attractive option for the community trials which SSE were conducting under the Energy Demand Reduction Project (EDRP). The main aim of the SSE community trials was to reduce the electricity consumption in the whole village by 10%, as measured through local substations. Though substation data collects all electricity information, the SSE intervention mainly targeted households, as there were very few businesses in the area. The local group agreed to work with SSE and promote energy efficiency to meet the 10% target, with an official meeting to launch the initiative taking place at the end of June 2007. An SSE employee was assigned to liaise with North Leigh and often attended meetings.[136] A second meeting, led by an external sustainable energy consultant, was held in September 2007. The purpose of the second meeting was to develop the community trial and was open to all community members. Subsequently, the local group held regular meetings, which were again open to the community, and held events and distributed information (discussed further below) to raise awareness of energy efficiency.

[136] There was a change in staff during the SSE intervention, and the first person who liaised with the community was replaced by someone else in June 2008. The initial person involved in North Leigh was also responsible for St Athan and Alyth; however, when that person left the organisation, SSE assigned three people to work with the communities (one for each community).

The SSE trial also focused on unique ways to provide feedback to customers. SSE supplied smart meters to many of its customers in North Leigh, which involved replacing existing electricity meters with the new smart meters. The project started with SSE testing the smart meters in about six houses. There were delays with the smart meters, due to delays from the manufacturers and for other technical reasons. The installations began to be trialled in North Leigh in September 2007, but the full installation programme began in May 2008, and concluded at the end of 2008.

In December 2007, SSE also arranged for infrared thermal imaging of around forty houses and the Memorial Hall. These results were given back to those householders and displayed at a community evening 're-launch' event in January 2008. The next initiative from SSE was offering free insulation to the first 25 applicants, and then cost-price insulation to other North Leigh households. This was advertised through the community newsletter and a meeting was held to explain the offer. Twenty-six households contacted SSE about the insulation offer, and 16 of those actually had the insulation installed. SSE also updated North Leigh's 'light bulb library'. Another promotion included vouchers worth £25 that were offered for the purchase of low-energy bulbs from a local shop; this was apparently a very successful initiative, according to SSE. A further one-time initiative over the summer of 2008, to attract people to one of the events, was the provision of £500 vouchers for A and A+ rated appliances. Further, starting in August 2008, an SSE employee trained in giving energy efficiency advice was given the remittance to work directly in North Leigh, as part of a trial initiative. This employee approached SSE customers to offer advice and distribute free current cost monitors, attended the 'Challenge North Leigh' meetings, and eventually was assigned to hold surgeries in the North Leigh library on given days so that people could approach him for advice.

8.2.1.3 'Challenge North Leigh' group

The 'Challenge North Leigh' group was originally led by an enthusiastic local resident who was also the resident volunteer who led the previous energy efficiency project in the village. However, he stood down from leadership in about November 2007,[137] though remained very actively involved throughout the community trial. This person was mentioned more than anyone else in the qualitative findings; he seemed to be widely known and appreciated around the village for his involvement with promoting energy efficiency. The group initially set up a steering group, and eventually appointed one person as the leader of the group. The group established a logo for the project

[137] The leader stood down due to illness.

and printed t-shirts with the logo. The group met regularly[138] and was supported financially by SSE for any initiatives they chose to undertake and which were also approved by SSE.[139] The group decided to extend the focus of the events and activities beyond energy efficiency to include issues of climate change, more broadly, and sometimes related environmental issues such as recycling. They would advertise in the local paper (the Nor'Lye News), with leaflets, banners and maintained a website[140] which contains: minutes of their monthly meetings, advertisements for the events, and energy efficiency advice (Challenge North Leigh 2009). One of the initiatives was a calendar, which the group created, containing pictures of local residents. The calendar had the 10th of each month marked as a 'Power Down' day to remind people of the 10% challenge. There were two events that took place over the summer of 2008. A 'Green Fair' took place in July 2008, which included stalls, a hog roast, a bouncy castle, along with people available to give advice on energy efficiency. SSE also gave out current cost monitors at the fair. There were other events which included a Green Picnic and a Winter Fair (November 2008). At the Winter Fair, a specific insulation offer was promoted.[141] In 2009, there was another Green Fair and Green Picnic. There were other events, as well, such as screening of movies,[142] 'Give and Take' events, and further events in the summer of 2010.

8.2.1.4 Focus groups in North Leigh

North Leigh was the first village in which the author conducted focus groups. The method of using focus groups was developed in an iterative process, and the lessons learned from North Leigh helped shape the future focus groups in Alyth and St Athan.

Four focus groups were organised over two days, on Friday, 30th October 2009 and Saturday, 31st October 2009. Three of the focus groups included householders who had returned the postcard included in the second point of contact (i.e. with the questionnaire), and are called 'residents' in Table 8-1. The fourth focus group was conducted with the 'Challenge North Leigh' members, i.e. the local organising group. Table 8-1 summarises the composition and timing of the groups.

[138] Usually monthly; minutes are on the Challenge North Leigh website (Challenge North Leigh 2009).
[139] The group in North Leigh (and the groups in St Athan and Alyth) had a budget from SSE of approximately £30,000.
[140] http://www.challengenorthleigh.org/
[141] Vouchers for £50 discount on SSE's insulation scheme for able-to-pay customers were available.
[142] For example, they showed the film *The Age of Stupid*

Table 8-1: Number of invitations and confirmation for focus groups in North Leigh

Group	Date & Time	First wave of invitations	Subsequent invitations	Number confirmed	Final number
Residents	Friday, 5.15pm	8	7	4	5
'Challenge North Leigh'	Saturday, 11am	Uncertain	Uncertain	7	8
Residents	Saturday, 1.30pm	8	6	3	3
Residents	Saturday, 4pm	8	3	4	3

Based on the experience in North Leigh, it was decided that only one focus group of *residents* would be conducted in the remaining villages, in addition to the focus group conducted with each local organising group, as the initial results did not seem to justify the use of more people to arrive at similar conclusions. Analytic induction indicates that cases should be gathered until the hypothesis can no longer be disproved (Bryman 2008). Analytic induction has been criticised, however, for insufficient guidelines on the number of cases that are necessary before the "validity of the hypothetical explanation ... can be confirmed" (Bryman 2008, p.540-541). In this case, an inference had to be made as to the utility of conducting more than one group with the residents. Given that the energy efficiency groups in each village also comprised village members, there were actually already two opportunities for collecting information from resident householders. It was thus decided, subsequent to the North Leigh focus groups, that only two focus groups would be conducted in the other two villages: one with *residents* who replied to the questionnaire, and one with the *local organising group*. Thus, in order to facilitate comparison to the other two villages, all the findings from the resident focus groups in North Leigh were combined into one research output (see Table 8-2 and Figure 8-2 and Figure 8-3).

A standard interview guide was used for all three resident groups, and a slightly altered guide was used for the 'Challenge North Leigh' group (see Appendix G). Each guide focused on aspects of communication of energy efficiency information and the promotion of energy efficiency awareness.

Table 8-2 contains very brief summaries of the focus groups.

Table 8-2: Brief summary of focus groups in North Leigh

Group	Author's summary
Challenge North Leigh	Generally, it seemed that the group felt like they had to try a multitude of methods for spreading the message, and that some people would listen to some messages (cost, for example) and some would listen to other messages (climate change, for example). Concerns were expressed about the motivations the group was promoting (i.e. cost vs. climate change) to encourage people into being energy efficiency, but it was also admitted that many messages were needed in order to reach different people. It also seemed like a constant learning process. When Challenge North Leigh started, there was mention that it was perhaps not structured in the best way to reach people, but that it evolved over time. The groups was originally very focused on energy efficiency, but adapted to encompass wider environmental initiatives in order to reach a wider range of people. The events, such has movie nights and fairs, appeared to be a good way to bring in a variety of people. Having a representative from Southern Electric on hand in the village seemed very important for spreading the message and implementing actions, as well.
Residents	Overall, energy efficiency did not seem like a main topic that came up in conversations. However, all seemed aware of the issues from the local newsletter (Nor'Lye News), as there is evidently a little section that mentions it every month. And when discussions progressed, there were generally examples of speaking with other people for information. Respondents preferred generally to get information from people who had experience or from professionals, and a couple of respondents mentioned they would approach energy companies, whilst a few more indicated they would not approach an energy company because they did not think it was on the agenda of energy companies to want to 'save' energy. People indicated they might not speak to other people because it either was not an important topic, or they were not sure they could get good advice. The local campaign from 'Challenge North Leigh' seemed to be most important for raising awareness and inspiring people to take the message seriously, in addition to one individual who was quoted more than once has having a 'passion' for the subject. Actions, or behaviours, were not directly linked to the group, though, except in the handout of free light bulbs and also the free initiatives (of insulation, for example) that were occasionally offered. As far as receiving advice, a couple people mentioned that they did not think people should be 'talked down to'. There was also talk about how expensive some things (like insulation) are, and that costs can be prohibitive. As well, time seemed to be an issue, particularly for those who worked full-time outside of the home. All three groups mentioned how messages were spread through schools and children taught or encouraged their parents on energy efficiency.

Using content analysis, which was informed by the interview guide, but also included information that arose from the text analysis through iterative coding, findings emerged that are presented in the models below (Figure 8-2 and Figure 8-3). The five broad categories, which applied to both the residents and the 'Challenge North Leigh' group, were: awareness, communication, adoption of innovations, trust and unique village aspects. These findings were then categorised to address the hypotheses; the full tables are presented in Appendix G.

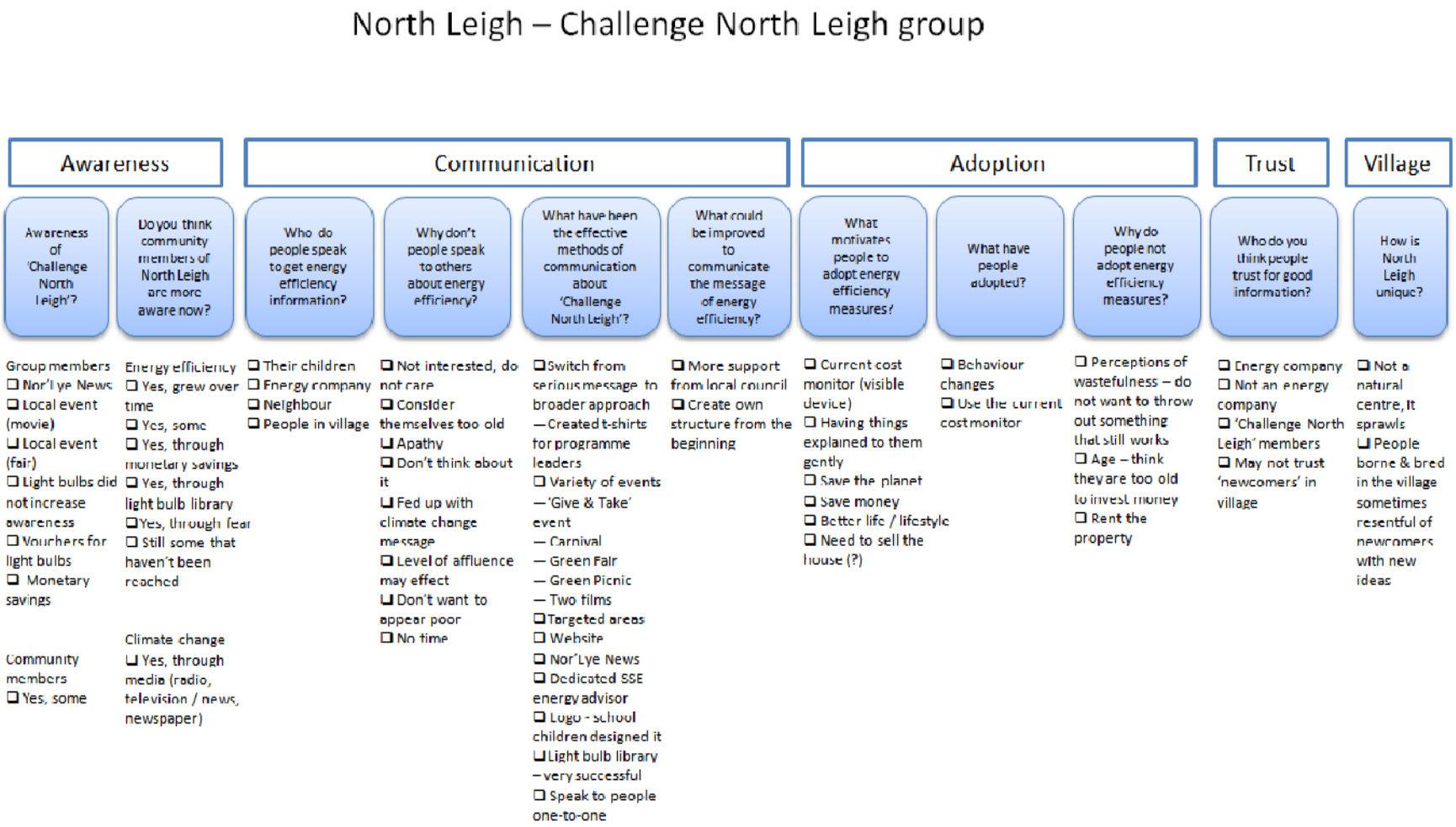


Figure 8-2: North Leigh local organising group, focus group summary

Figure 8-3: North Leigh local residents, focus group summary

8.2.2 St Athan

St Athan is a former farming village in the Vale of Glamorgan, Wales which is composed of approximately 540 households.[143] The village has a church, a school, a nursery, a library, a post office, a pharmacy, a community centre, several convenience stores, a few hairdressers, and two public houses. St Athan is known for being the location of a Royal Air Force (RAF) base, but RAF St Athan is located just northwest of the village, and is not considered part of the village of St Athan. However, it appears that the RAF base, and other local industry such as the power station and Lafarge Cement (both in neighbouring Aberthaw), brought at least some residents to St Athan. The village is located equidistant between Cardiff International Airport and the town of Llantwit Major. The nearest city is Cardiff to the northeast.

Figure 8-4: Map of St Athan[144]

8.2.2.1 Energy efficiency in St Athan

This was the only of the three community trials which did not have an established group that supported energy efficiency or wider environmental issues. SSE helped to

[143] As in Appendix J, the third party company which compiled the sampling frame indicated there were 543 dwellings. According to Census data compiled by the author, there were 518 dwellings in 2001. There were indications by residents at the beginning of the trials that numbers were more toward 600 households, and as emerged in the focus group, an additional housing development was constructed since that time. There is a Royal Air Force Base located in St Athan, adjacent to the village, but the housing for the RAF base was not included in any of the estimations here, nor was it included in the SSE trial.

[144] From Google Maps UK (http://www.maps.google.co.uk/), © 2011 Google – Map data © 2011 Google, Tele Atlas

create a group by engaging with local residents and others who were active in other local groups. Part of this recruitment effort involved sending invitations to organisations and businesses in the area. SSE also worked with the local energy efficiency advice centre, called South East Wales Energy Agency (SEWEA), which developed the initial programme, but which was only involved for a few months.

8.2.2.2 SSE community trial in St Athan

SSE, which is branded SWALEC in Wales,[145] approached St Athan due to the high number of customers in the area. SSE approached members of the local council, who were involved in establishing the local organising group, with support also offered by an environmental charity called Groundwork. The programme launched in March 2008, which was a bit later than the other communities due to the time involved in creating the local organising group. The first smart meter of the trial was installed in a test home at the end of April 2008. As of November 2008, 150 smart electricity meters had been installed. There were also some dual-fuel (i.e. gas and electricity) meters installed. Other interventions by SSE included offering free low-energy light bulbs; offering low-energy decorative light bulbs; and insulation offers. An SSE employee was assigned to liaise with St Athan and often attended meetings.[146] Another SSE employee was also assigned to offer advice to local householders in 2010. This employee would approach householders and also held a surgery once a week in the St Athan library.

8.2.2.3 'Get Smart with St Athan' group

This community group was formed for the specific purpose of promoting the SSE challenge of 10% electricity reduction, which would be rewarded with £20,000 for the village. Members of the group were identified by SSE and SEWEA and approached. Twenty people were initially invited, fourteen attended the first meeting, and eight of those ultimately signed up to be on the committee. A local county councillor who lives in the neighbouring village became the leader of the group. The group membership changed over time, as the original secretary moved out of the village, but the group still has a membership of about 8 people. The group's main aims were to raise awareness of energy efficiency and encourage residents to reduce their energy consumption to meet the SSE 10% reduction target. They created a logo, which was run as a competition for school children.[147] They communicated the message of energy

[145] SWALEC is an acronym for South Wales Electricity.
[146] There was a change in staff during the SSE intervention, and the first person who liaised with the community was replaced by someone else. The initial person involved in St Athan was also responsible for North Leigh and Alyth; however, when she left the organisation, SSE assigned three people to work with the communities (one for each community).
[147] They also created an image for a poster campaign, in the style of 'This Country Needs You' with a cartoon image of the group leader (the county councillor) pointing his finger toward the viewer. Neither of these were available to include.

efficiency by creating leaflets, posters, information packs, writing articles in the village newsletter and the school newsletter, and holding two pub quizzes. They had a few events, the most successful of which was when they 'piggybacked' on a Summer Fair by setting up a stall.

8.2.2.4 Focus groups in St Athan

Two focus groups were organised over two days, on Monday, 17th May 2010 and Tuesday, 18th May 2010. One of the focus groups included householders who had returned the postcard included in the second point of contact (i.e. with the questionnaire), and are called 'residents' in Table 8-3. The other focus group was conducted with the 'Get Smart with St Athan' (or 'Get Smart') group. Table 8-3 summarises the composition and timing of the groups.

Table 8-3: Number of invitation and confirmations for focus groups in St Athan

Group	Date & Time	First wave of invitations	Subsequent invitations	Number confirmed	Final number
'Get Smart'	Monday, 7.30pm	Uncertain	Uncertain	Uncertain	9
Residents	Tuesday, 7.15pm	12	6	4	1

An invitation was sent to the secretary of the 'Get Smart' group, who distributed it by email. Therefore, it was completely unknown how many people would attend, but the focus group took place after their regular monthly meeting, so it was highly likely that there would be at least a few people attending. In the end, the group total was nine, which included someone from the local council and a member of a charity (Groundwork) who was working with the group, in addition to the SSE representative for that community. In the residents group, however, four people had confirmed their attendance, but only one showed up. This therefore became a focused interview. Table 8-4 contains very brief summaries of the focus groups.

Table 8-4: Brief summary of focus groups in St Athan

Group	Author's summary
Get Smart with St Athan	After Get Smart's regular monthly meeting, during which they discussed the next events, the focus group took place. The group members seem to doubt that they have reached many people. They seemed positive in their general attitudes about energy efficiency, though. Many work fulltime, and some outside the village. There was a general feeling of being the 'guinea pig' of the community trials, specifically due to the fact that they were not provided with a trained energy efficiency officer until quite late into the project. A few respondents mentioned that the best way to get across the energy efficiency message was to speak to people, face-to-face. The efforts of the initiative that seemed to make the most impact were one particular event they held, which piggybacked on another fair, and the SSE employee who had recently started and gave door-to-door energy advice. They had a logo and advertised the project through leaflets.
Residents	The one respondent who attended was very focused on what he considered to be the biased information on energy, particularly on wind farms. He had been an engineer for many years, so seemed particularly knowledgeable about the technical elements of energy supply and demand. The lack of other members of the focus group prevented symbiotic interactions, which may have affected the tendency for the dialogue to stray from the topic. From his comments, there does not seem to be a culture for speaking about energy efficiency in the village.

Content analysis and iterative coding were used to produce Figure 8-5 and Figure 8-6. The same five broad categories were applied to both groups in St Athan as they were to North Leigh: awareness, communication, adoption of innovations, trust and unique village aspects. These findings were then categorised to address the hypotheses. This data is presented in full tables in Appendix G.

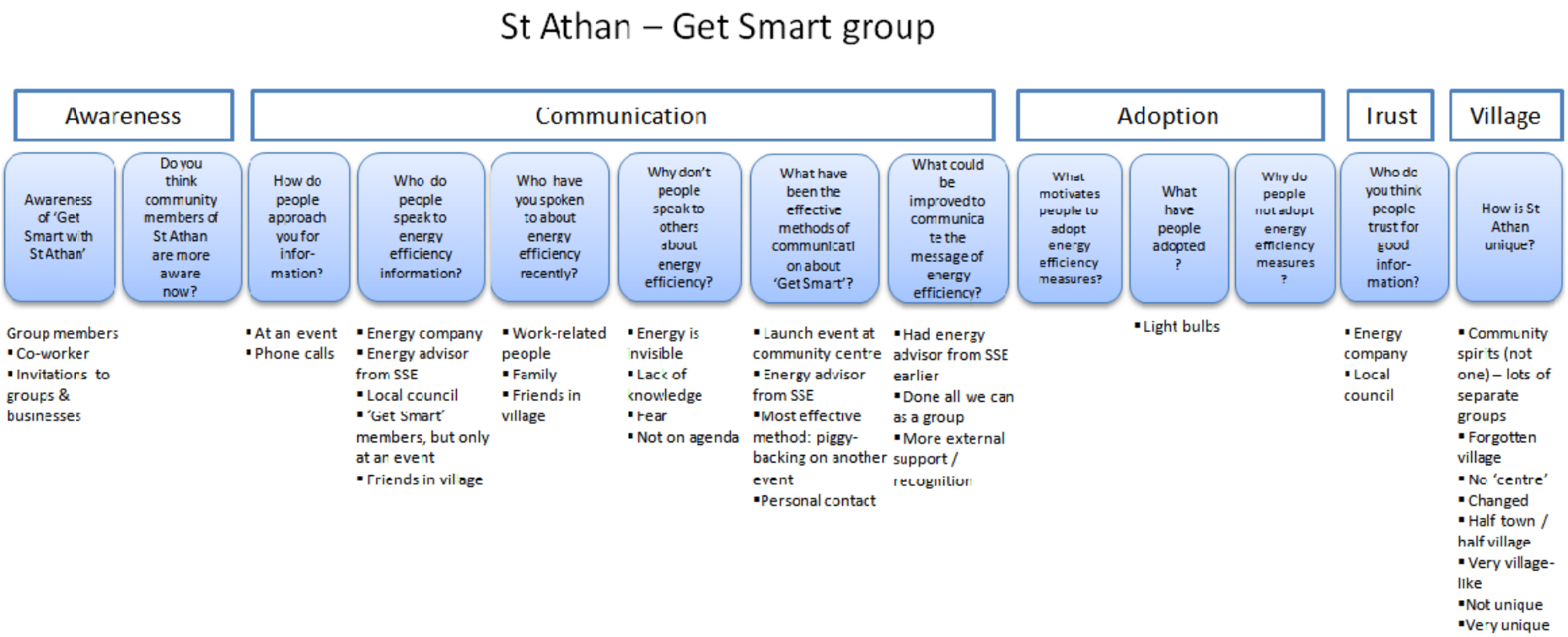


Figure 8-5: St Athan local organising group, focus group summary

Figure 8-6: St Athan local resident, focus group (interview) summary

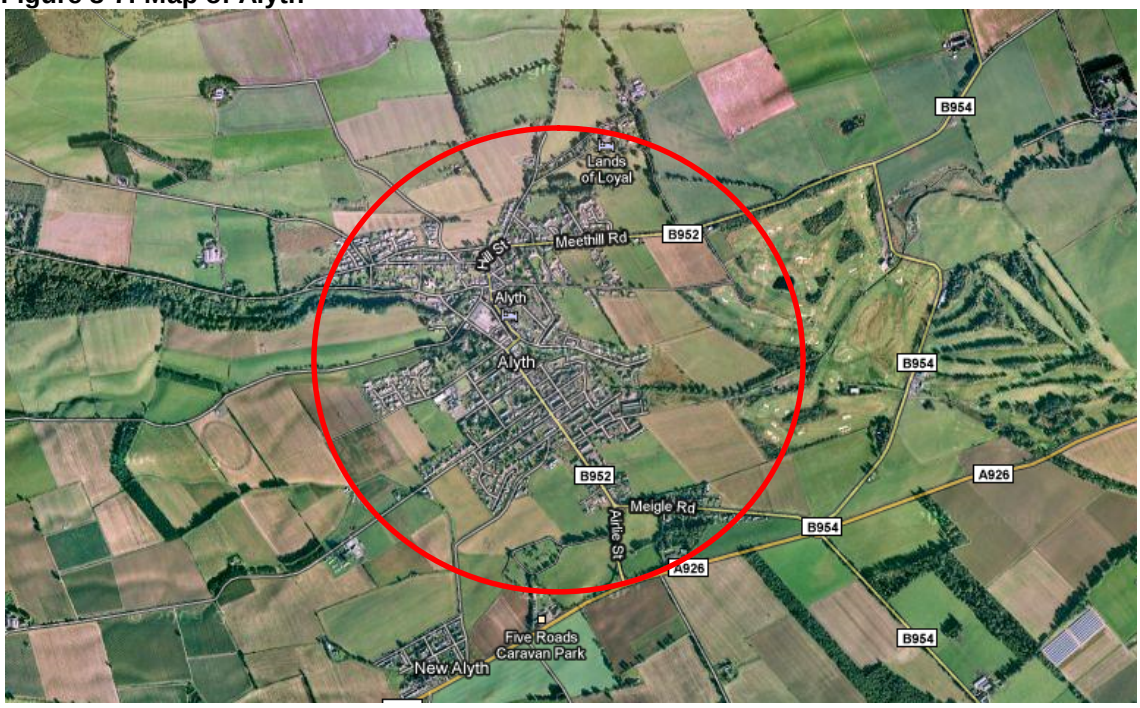
8.2.3 Alyth

According to the town website:

> "Alyth is a small town in the north east of Perthshire in Scotland. It is located on a burn which bears its name and owes its position to a confluence of droving roads used by hill farmers to bring their sheep down to market. The village has a population of 2,383 (1991). It has a primary school and a thriving center and outstanding community spirit" (*Alyth Climate Action Town* [Online]).

The town is comprised of approximately 1,400 households, according to those in the local organising group. There is a town hall, several churches and church halls, a small museum and a library. Alyth also has around 100 registered businesses, including several hotels, several pubs, approximately five garages, a classic car restoration specialist, other shops, and is surrounded by several farms. The nearest cities are Perth and Dundee.

Figure 8-7: Map of Alyth[148]



8.2.3.1 Energy efficiency in Alyth

Energy efficiency had been a topic that had already received attention in Alyth due to local effort. The Alyth Environmental Group (AEG), which had been in existence for several years prior, focuses on broad environmental issues such as cleaning up the local stream and maintaining footpaths. Members of the AEG spearheaded the Alyth Climate Action Town (ACAT) project, which was established in 2005. "Alyth Climate Action Town is a community lead initiative to help the community of Alyth collectively

[148] From Google Maps UK (http://www.maps.google.co.uk/), © 2011 Google – Map data © 2011 Google, Tele Atlas

recognise its role in the global climate change challenge and support all businesses, community groups and individuals living and working in Alyth to adopt a more sustainable life style" (*Alyth Climate Action Town* [Online]). The first aim of ACAT was to increase energy efficiency in Alyth, and in May 2006 they held an 'Energy Saving Exhibition' in the town. At this event, community members were given a chance to sign a pledge to reduce their greenhouse gas emissions. The activities of ACAT included:

> "*Promoting the installation of a biomass heating system in the Primary School
> *A feasibility study for micro hydro with in [*sic*] the Alyth Burn (unsuitable)
> *a thermal image survey of selected houses and community halls buildings
> *an number of films shows and guest lectures
> *participation in energy saving challenge project with Scottish Hydro Electric
> *Interactive community events with an energy theme in association with Sensation Dundee.
> *Project marketing and branding including TV and radio interviews with BBC Scotland" (*Alyth Climate Action Town* [Online])

The ACAT group was subsequently approached by SSE to promote the energy efficiency intervention which included installation of smart meters and a 10% reduction target for the whole community. ACAT agreed to support this initiative and called it the 'Alyth Energy Challenge'. During the community trial, ACAT also made a bid to the Scottish Government for the Climate Challenge Fund. They were successful in this bid, details of which are described below.

Previous to the SSE intervention, SSE had developed a 16-turbine windfarm nearby in Drumderg, which was made operational in late 2008. In order to build this windfarm, lorries had to carry all the equipment for the wind turbines directly through the centre of Alyth, as this was the only route to reach Drumderg. There was apparently local opposition to the construction initially, but those participating in the local residents focus group indicated that they did not oppose the wind farm, and indicated that it had raised awareness of sustainable energy issues.

8.2.3.2 SSE community trial in Alyth

SSE, which is branded as Scottish Hydro Electric in Scotland, launched the intervention at an event in September 2007, though officially began in October 2007 (*Alyth Climate Action Town* [Online]). Another event was held in November 2007, facilitated by a third party, to establish the development plan of the two-year project. Initially, a local energy advice centre called Save Cash and Reduce Fuel (SCARF) was involved, as well. The first two smart meters were installed on 24 January 2008 in the homes of the project leaders of the 'Alyth Energy Challenge' group. In February 2008, BBC Scotland conducted radio and television interviews with Alyth residents and SSE staff, as the initiative had attracted media attention. In May 2008, a selection of about

30-35 houses was surveyed with a thermal imaging camera. These were displayed at a community energy event in Alyth later that month. The full smart meter installation programme began in July 2008. These smart meters were only smart electricity meters, despite efforts to initially try to install dual-fuel meters. At the end of November 2008, there were almost 300 smart meters installed. SSE also supported the activities of the ACAT group, which included insulation offers and provision of free light bulbs, in addition to awareness raising initiatives, which are described below. An SSE employee was assigned to liaise with Alyth and often attended meetings.[149]

8.2.3.3 'Alyth Energy Challenge'

As mentioned above, the SSE project was considered an initiative within the ACAT group, and was called the 'Alyth Energy Challenge'. The group created a logo and printed t-shirts and window stickers so that households could say they were taking part in the trial. They had several events, including a gala and other energy fairs, and viewings of environmentally-focused films. They set up a library of current cost monitors, whereby people could borrow them and try them out for a short time. They put ads in the local newsletter, the *Alyth Voice*, and the local paper of the wider area, the *Blairgowrie Advertiser*. They created banners which were hung at two ends of the town. They delivered leaflets to every household, created posters which were hung in town, and gave bookmarks with the logo on it to schoolchildren. They also created an 'energy badge' for Boy Scouts and Girl Guides to earn.

In September 2008, ACAT, under the auspices of the Alyth Environmental Group, also won additional funding from the Climate Challenge Fund.[150] With this funding, the group began what was referred to by ACAT members as the 'street-by-street' insulation campaign. This street-by-street campaign began in November 2008 and concluded in May 2010 and involved visiting as many houses as possible to perform energy audits and encourage the installation of insulation and other energy efficiency measures. The street-by-street campaign hired a part-time co-ordinator for this project, as well as additional energy assessors. They had a small drop-in centre called 'The Hub' in the middle of town which was open a few mornings and evenings each week, and was used for other meetings. The initial task of the street-by-street campaign was to

[149] There was a change in staff during the SSE intervention, and the first person who liaised with the community was replaced by someone else. There was initially one woman who worked with Alyth and the other two communities, but there was also another SSE employee who had been involved during her assignment; when the woman left the organisation during the trial, the other SSE employee took on the full responsibility of liaising with the local organising group.

[150] The Climate Challenge Fund "aims to help Scottish communities make a real difference by significantly reducing their carbon emissions. It was proposed by the Scottish Greens during the 2007 Scottish Parliamentary elections, and adopted by the Scottish Government as part of the budget negotiations in early 2008. The Fund is £27.4m over three years (2008-11)" and is administered by Keep Scotland Beautiful (Natural Scotland, Scottish Government 2009).

distribute Energy Saving Trust 'Home Energy Checks', which are questionnaires that ask about specific energy measures in a home. They distributed these to 1,400 households in June 2009. They received approximately 380 responses. The seven energy assessors visited these homes in the following weeks. The Energy Saving Trust created 'home energy reports' from the questionnaires which had been distributed, making recommendations to each household. Generally these were sent to ACAT, and then the energy assessors took them to the respondent and explained what they meant and what could be done.[151] As of July 2009, they had about 180 reports returned, and by December 2009 they estimated that energy assessors had been to approximately 300 households.

There were thus at least two initiatives[152] which were running in parallel, both focusing on energy efficiency, in Alyth. From an organisational perspective, information from the Alyth Energy Challenge focus group indicated that respondents felt the efforts of the Climate Change Fund 'street-by-street' campaign may have made a bigger impact than the SSE-backed initiative. However, information from the residents focus group indicates that householders were unable to distinguish between the two initiatives.

8.2.3.4 Focus groups in Alyth

Two focus groups were organised over two days, on Wednesday, 9th December 2009 and Thursday, 10th December 2009. One of the focus groups included householders who had returned the postcard included in the second point of contact (i.e. with the questionnaire), and are called 'residents' in Table 8-5. The other focus group was conducted with the 'Alyth Energy Challenge' (ACAT) group. Table 8-5 summarises the composition and timing of the groups.

Table 8-5: Number of invitations and confirmation for focus groups in Alyth

Group	Date & Time	First wave of invitations	Subsequent invitations	Number confirmed	Final number
Residents	Wednesday, 7.30pm	11	7	6	4
ACAT / Alyth Energy Challenge	Thursday, 7.30pm	Uncertain	Uncertain	Uncertain	10

An invitation was sent to the leader of the ACAT group, who distributed this invitation to each member. Therefore, it was completely unknown as to how many people would

[151] In some cases the reports were sent directly to householders, which appears to have been a mistake.
[152] In addition, Alyth also has access to a community benefit fund developed established by the SSE local wind farm at Drumderg. The fund is for the benefit of local community groups to strengthen the community and improve quality of life, which could include energy efficiency measures, of both Alyth and neighbouring Mount Blair. The fund, which began in January 2007, totals £64,000 per year for 25 years (Scottish Community Foundation 2007). It is not clear if any group has accessed this funding. Further, there is another initiative called the Alyth 2020 campaign, which was mentioned in passing in the focus groups and appears to be at least partially back by the Community Council (*Alyth 2020* [Online])

attend, but there the turnout was the largest of any group with 10 people. In the residents group, six people had confirmed their attendance, and four showed up. Table 8-6 contains very brief summaries of the focus groups.

Table 8-6: Brief summary of focus groups in Alyth

Group	Author's summary
ACAT / Alyth Energy Challenge group	This group consisted of those who focused on the Alyth Energy Challenge in addition to those who focused on the street-by-street campaign. The efforts of these groups were organisationally distinct. Much of the discussion consisted of the two groups asking each other about what happened in the others experiences. For the street-by-street, they had hundreds of responses, but had to really put a lot of time in to reach people at convenient times, etc., for follow-up. It emerged that no one in the village had asked for the credentials of the street-by-street campaigners, which struck everyone as a bit odd on reflection, and also seemed to indicate a sense of trust in the community members. The ACAT members working on the Alyth Energy Challenge held many events and did quite a bit of creative advertising and awareness-raising. However, there also seemed to be a slight feeling of disappointment, as the substation meter readings at that time did not appear to reflect the savings they were trying to achieve. There was also desire to try to match the substation data with specific areas of energy use in the town, but this task seemed difficult. There was much more talk of fuel poverty in this community than in others. This community was much bigger than the other two communities, having over 100 businesses and many community groups. There was a bit of brainstorming at the end regarding how to copy the model of another local town in establishing a community development trust.
Residents	The respondents in this category all seemed to be aware of energy efficiency, though it was talked about in varying degrees. Most of them had read about it in the Alyth Voice, or had seen signs or talked to the leader of the group. One respondent in particular indicated several things that had done in home, but said it would not considered to speak to friends about it. All seemed to be aware of something happening in the village, but had not heard of the street by street campaign, mainly just the name ACAT and a newer initiative called 2020. They all knew about a local wind farm, mainly due to the fact that the route for all the building construction of it went straight through the centre of town. The respondents listed several reasons why other people might not think about energy efficiency, including lack of interest and complacency. There was also talk about how the UK is quite small in its environmental impact compared to other countries. They seemed quite proud of their town, though had issues with the local transport, which was talked about quite a bit.

Content analysis and iterative coding were used to produce Figure 8-8 and Figure 8-9. The same five broad categories were applied to both groups in Alyth as they were to North Leigh and St Athan: awareness, communication, adoption of innovations, trust and unique aspects of the town. These findings were then categorised to address the hypotheses which are in Appendix G.

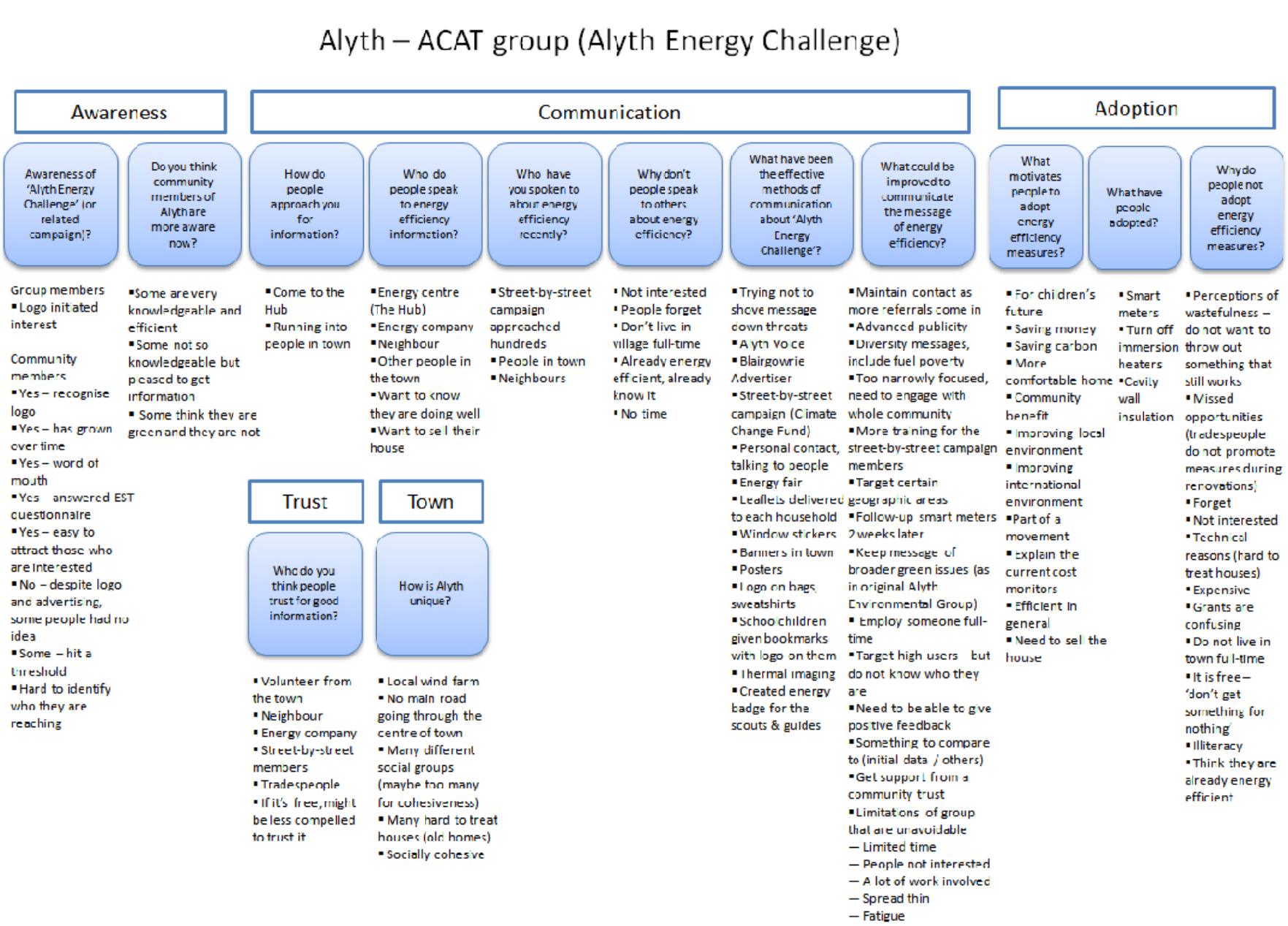


Figure 8-8: Alyth local organising group, focus group summary

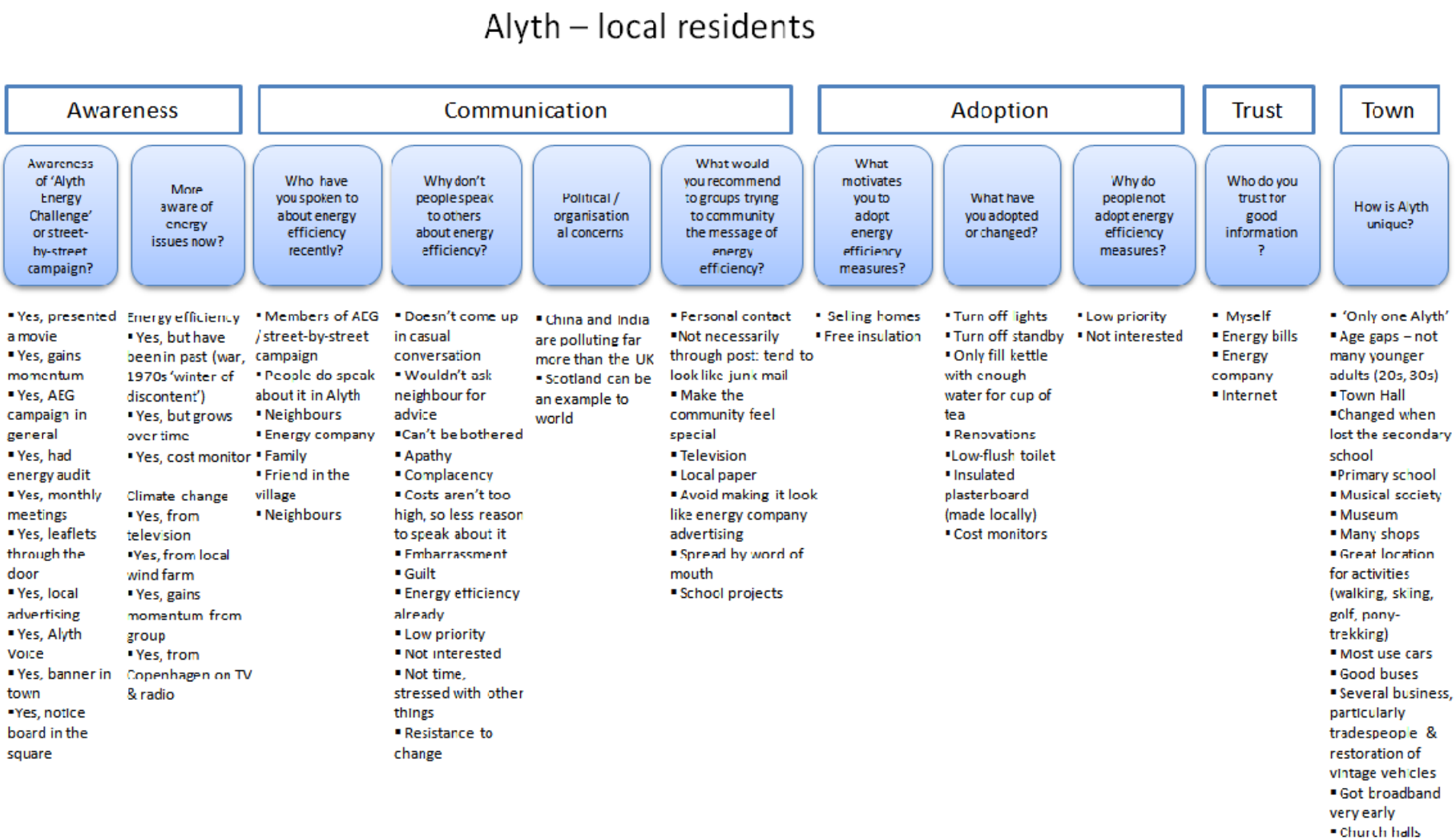


Figure 8-9: Alyth residents, focus group summary

8.3 Comparison of communities

This section highlights key findings of the descriptive (quantitative) statistics, which are fully outlined in Appendix J, and contextualises them with the summary (qualitative) findings. Descriptive statistics are those statistical analyses which are meant to "summarize the characteristics of a data set" in order to "reduce the whole collection of data to simple and more understandable terms without distorting or losing too much of the valuable information collected" (Weinbach & Grinnell 1998, p.17). There are also inferential statistics included based on bivariate (i.e. two variable) analysis. "Inferential statistical analysis uses procedures for determining how safe it would be to make generalizations about the characteristics of a population (parameters) based on the characteristics of the population's sample (statistics)" (Weinbach & Grinnell 1998, p.17). The qualitative findings which contextualise the statistics are based on the models outlined in section 8.2 for North Leigh, St Athan and Alyth, and on the statements arising from focus groups.

8.3.1 Data preparation

In order to accurately represent data, assurances must be made that the data reflects the answers given by respondents as accurately as possible. As is fully discussed in Appendix I, data preparation included programming and data entry in CSPro 3.3 (U.S. Census Bureau et al. 2008), data coding, importation of data into SPSS 17.0 (SPSS Inc., *SPSS 17.0*), data cleaning, and consideration of methods to address missing data. Once these preliminary actions had been taken, it was possible to conduct the descriptive and inferential statistical tests as described in this chapter.

8.3.2 Response rates

The response rates of the self-completion questionnaires, as summarised in Table 8-7, were based on the number of returned and completed questionnaires divided by the total number which were distributed.

Table 8-7: Response rates of self-completion questionnaires

Name of community	Total number distributed (a)	Total completed & returned (b)	Response rate (b÷a)
North Leigh	364	227	62.4%
St Athan	330	186	56.4%
Alyth	782	479	61.3%

The final response rates were very similar in North Leigh (62.4%) and Alyth (61.3%), which were both a bit higher than the response rate in St Athan (56.4%). All of these response rates fall within expected estimates using the Total Design Method, i.e. between 50-70% (Dillman 1991). In comparison, other self-completion questionnaires

sent to householders on the topic of energy have achieved response rates of between 8.1% and 47.1% in the UK (Wallace et al. 2010), between 36% and 47% in Sweden (Mahapatra & Gustavsson 2010; Nair et al. 2010), 64% in Canada (Parker et al. 2003), and 71% in New Zealand (Ball et al. 1999).

8.3.3 Socio-demographics of communities

A summary of the variables of gender, age, education and if a couple live in the dwelling is given in Table 8-8.

Table 8-8: Summary of socio-demographic variables

Variable		**North Leigh** (Total N=227)		**St Athan** (Total N=186)		**Alyth** (Total N=479)	
		N	**%**	N	**%**	N	**%**
Gender	Male	97	**42.7**	81	**43.5**	199	**41.5**
	Female	127	**55.9**	100	**53.8**	263	**54.9**
	Missing	3	**1.3**	5	**2.7**	17	**3.5**
Couple in a dwelling	Yes	85	**37.4**	94	**50.5**	227	**47.4**
	No	139	**61.2**	86	**46.2**	234	**48.9**
	Missing	3	**1.3**	6	**3.2**	18	**3.8**
Age (years)	16-24	1	**0.4**	3	**1.6**	1	**0.2**
	25-44	45	**19.8**	34	**18.3**	87	**18.2**
	45-64	107	**47.1**	81	**43.5**	183	**38.2**
	65-74	35	**15.4**	28	**15.1**	109	**22.8**
	75+	36	**15.9**	38	**20.4**	87	**18.2**
	Missing	3	**1.3**	2	**1.1**	12	**2.5**
Education	Degree, or equiv, or above	85	**37.4**	20	**10.8**	117	**24.4**
	Another kind of qualification	90	**39.6**	93	**50.0**	181	**37.8**
	No qualifications	44	**19.4**	67	**36.0**	156	**32.6**
	Missing	8	**3.5**	6	**3.2**	25	**5.2**

In order to examine the similarities and differences that appear in Table 8-8, and to test reliability by cross-case comparison, statistical tests were performed. As the variables gender and couple living in a dwelling are both categorical[153] and include independent populations, Pearson's chi-square tests were performed in Excel, using the frequencies above, excluding those with missing data (Field 2005). Pearson's chi-square test is a statistical test used to investigate the relationship between two categorical variables with two or more levels, based on deriving a statistic (Pearson's chi-square, χ^2) from the categorical variables placed in a contingency table,[154] using the formula in Equation 1 (Field 2005).

[153] A categorical variable (or nominal variable) has two or more categories, but "there is no implication of a quantifiable difference among its value categories; therefore, no rank-ordering of value categories is possible" (Weinbach & Grinnell 1997, p.10).

[154] A contingency table is "a table representing the cross-classification of two or more categorical variables" (Field 2005, p.726), and is another name for a crosstabulation.

Equation 1 (from Field 2005, p.683)

$$\chi^2 = \sum \frac{(Observed_{ij} - Model_{ij})^2}{Model_{ij}}$$

The observed frequencies ($Observed_{ij}$) are those entered into the contingency table. The model frequencies ($Model_{ij}$) are those derived from Equation 2, where *n* is the total of all observed frequencies in the contingency table.

Equation 2 (from Field 2005, p.683)

$$Model_{ij} = \frac{Row\ Total_i * Column\ Total_j}{n}$$

Once the χ^2 is calculated, a significance level indicating the association between the two variables can also be derived, using the chi-square statistic and the degrees of freedom (*df*), which is one less than the number of rows multiplied by one less than the number of columns (i.e. a 2x2 contingency table yields a *df* of: (2-1)*(2-1) = 1). The significance value (*p*) is the acceptable level of confidence in the resulting model. As a general rule, if the significance is less than 95% (i.e. anything greater than 0.05), then sufficient confidence is lacking (Field 2005).[155] SPSS 17.0 automatically produces the significance level and it can be derived in Excel if the chi-square statistic and degree(s) of freedom are known.

For the socio-demographic variables of gender and couple status, Pearson's chi-square reveals the difference between observed and expected frequencies. The gender of the respondents (i.e. male or female) did not vary significantly between North Leigh and St Athan (χ^2 (1) = 0.085, *p*= .770), or between North Leigh and Alyth (χ^2 (1) = 0.003, *p*= .954) or between St Athan and Alyth (χ^2 (1) = 0.149, *p*= .670). This indicates that fairly similar proportions of people, in terms of being male and female, responded to the questionnaire. Regarding the presence of a couple in the household, there was a significant difference between North Leigh and St Athan (χ^2 (1) = 8.243, *p*< .001) and North Leigh and Alyth (χ^2 (1) = 7.754, *p*< .001), but not between St Athan and Alyth (χ^2 (1) = 0.460, *p*= .497). Examining Table 8-8 again reveals that far more respondents from North Leigh indicated that their household did not include anyone living in a couple.

[155] A *p*-value less than 0.05 indicates significant associations, which means the variables vary in some way. A *p*-value greater than 0.05 indicates that the variables do not significantly vary from each other.

For the two other socio-demographic variables, education and age, an appropriate test for comparing ordinal variables[156] of each community in turn is the Mann-Whitney test.[157] This is a non-parametric test that is equivalent to the independent *t*-test,[158] but is designed for ordinal data (Argyrous 1996; Field 2005), and is based on ranked sums. The test involves assigning a rank to each value; the lowest value is assigned a rank of 1, the second lowest is assigned a rank of 2 and so forth.[159] The ranks are then added (i.e. sum of ranks). The Mann-Whitney test "compares the number of times a score from one of the samples is ranked higher than a score from the other sample" (Bryman & Carter 2001, p.133), with the significance of the statistic (*U*) based on a *Z*-score statistic[160] (Bryman & Carter 2001), all of which are calculated in SPSS 17.0.

Mann-Whitney tests revealed no significant differences between the age of respondents in North Leigh and St Athan (*U*=19754.0*, p*=.444), North Leigh and Alyth (*U*=47848.0*, p*=.056), or St Athan and Alyth (*U*=41261.0*, p*=.409). This indicates that the respondents from each community did not significantly vary in each age grouping. However, there were significant differences in education between North Leigh and St Athan (*U*=13281.0*, p*<.001), North Leigh and Alyth (*U*=40191.5*, p*<.001), and St Athan and Alyth (*U*=36060.5*, p*<.05). Examining Table 8-8, it appears that there were far fewer respondents with a degree or above in St Athan, and fewer respondents with no qualifications in North Leigh.

Summarising the findings, it appears that those who responded to the questionnaires represented similar gender and living situation (i.e. a couple lives in the home), verified with chi-square tests, although North Leigh differed regarding living situation. Mann-Whitney tests indicated that the case communities are not dissimilar in terms of age, but they do vary in reported education levels.

8.3.4 Communities compared to 2001 Census data

Further comparisons were made between the socio-demographic variables in Table 8-8 and one addition variable (i.e. whether the respondent owned or rented their

[156] An ordinal variable assumes a distinctive quantitative measure which "tell us not only that things have occurred, but also the order in which they occurred" but "tell us nothing about the differences between values" (Field 2005, p.740).
[157] The Mann-Whitney test is equivalent to the Wilcoxon rank-sum (Field 2005; Argyrous 1996).
[158] The independent *t*-test measures the difference in means, when "there are two experimental conditions and different participants have been used in each condition" (Field 2005, p.296) and is appropriate for normally-distributed interval data.
[159] Multiple equal values would generally have different ranks (i.e. tied ranks), but the practice is to "divide the sum of the ranks to be filled by the number of ranks to be filled" (Argyrous 1996, p.247).
[160] A *Z* statistic is derived by subtracting the overall mean from each score and dividing by the standard deviation (Field 2005).

home), as compared to 2001 Census data for each community, which is explained in Appendix J. Pearson's chi-square tests were used to compare the communities.[161]

Summarising the case study versus 2001 Census findings in Appendix J, it appears that each community was different from the 2001 Census in terms of self-reported age and whether the respondents' owned or rented their property. The same was true for gender in North Leigh. However, case study respondents in St Athan and Alyth seemed to more accurately represent the male/female reports from the 2001 Census, based on the non-significance of the chi-square results. Due to missing data in the North Leigh and Alyth 2001 Census data sets, comparisons of education and living in a household with a couple were not possible. In St Athan, it appears that respondents were representative of the population in terms of education but not in terms of reports of couple-occupied households. See Appendix J for the compared frequencies of these and other variables.

Consideration was given to weighting the data according to the population characteristics from the 2001 Census.[162] However, for each variable, it was difficult to calculate an exact population item statistic, e.g. the 2001 Census data included all those male or female, regardless of age, whereas it is restricted to those over 16 in the case communities. In addition, the nature of a case study and the non-probability sampling means that though the case studies are meant to in some way represent each the whole community, it is not necessary to do this. Therefore, data was not weighted.

8.3.5 Community characteristics and energy awareness

There were questions at the beginning of the 'Energy Efficiency in your Community' questionnaire which illustrated community characteristics and details of reported energy awareness and knowledge.

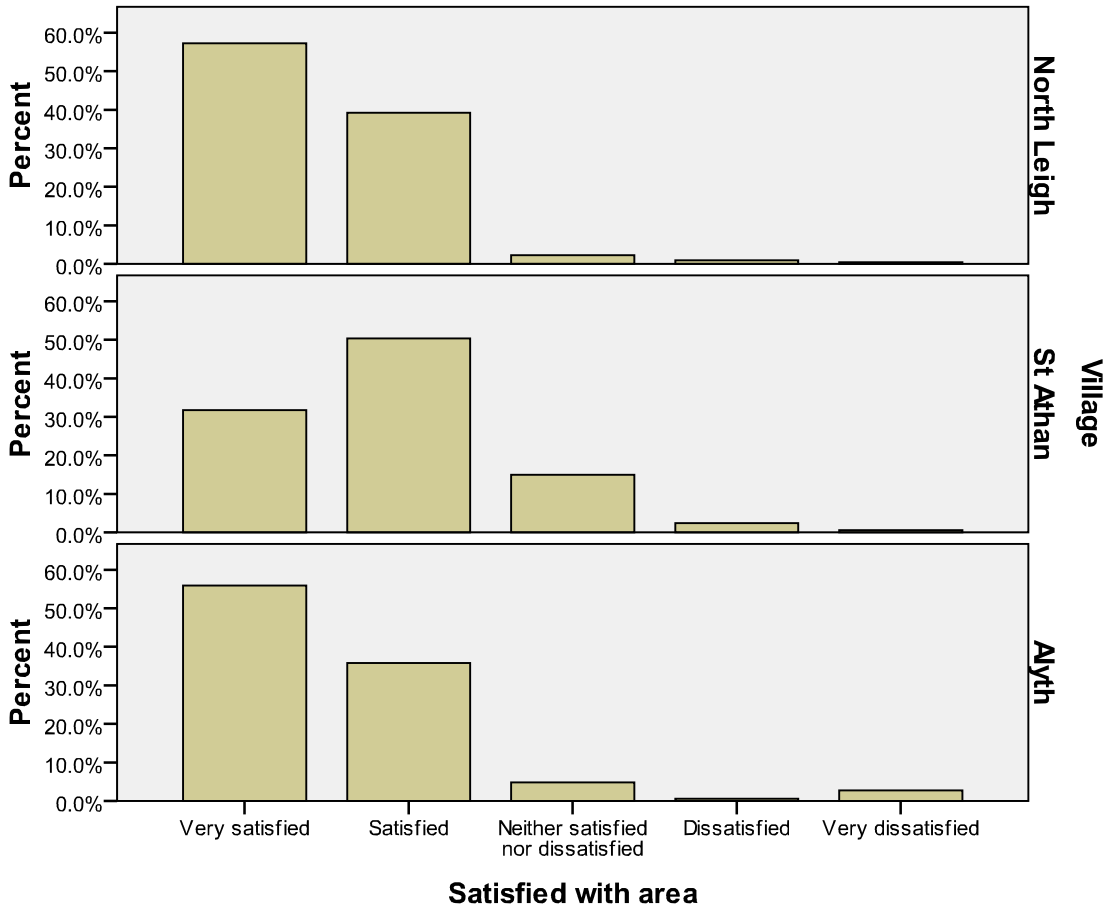
Regarding the length of time the respondents indicated living in their communities (Question 1), a slightly higher percentage of residents in St Athan (57.4%) and Alyth (51.9%) indicated living in their area for 20 years or more, as compared to North Leigh (43.9%), the difference of which was statistically confirmed through Mann-Whitney tests (see Appendix J). Though not meant to be representative of the population communities, the focus group respondents reflected fairly similar findings: slightly fewer

[161] Mann-Whitney tests were not deemed appropriate as the full data sets were not available to rank. It is also not uncommon to measure ordinal variables with Pearson's chi-square test.
[162] Weighting data is a method of addressing bias in samples (de Vaus 2002b). "The need to weigh usually arises when a probability sample ... has been taken and the researcher knows or discovers that some categories of cases in the sample have been overselected or underselected" (Miller et al. 202, p.93-94).

respondents in North Leigh indicated living in North Leigh for 20 years or more (37.5%), as compared to St Athan (57%) and Alyth (50%).

Regarding satisfaction with the community (Question 2), the majority of respondents were either very satisfied or satisfied with their area as a place to live. However, more respondents said 'very satisfied' than 'satisfied' in both North Leigh and Alyth, which was not the case in St Athan. Mann-Whitney tests confirmed these findings: there were significant differences between North Leigh and St Athan (*U*=12872.5*, p*<.001) and Alyth and St Athan (*U*=29146.0*, p*<.001), but not between North Leigh and Alyth (*U*=50686.5*, p*=.430).

Figure 8-10: Self-reported of satisfaction with area (percent)



The qualitative findings did not yield obvious differences between villages; some respondents considered a community socially cohesive, while others either did not or thought that multiple small cliques existed, but not one overall 'community spirit'.

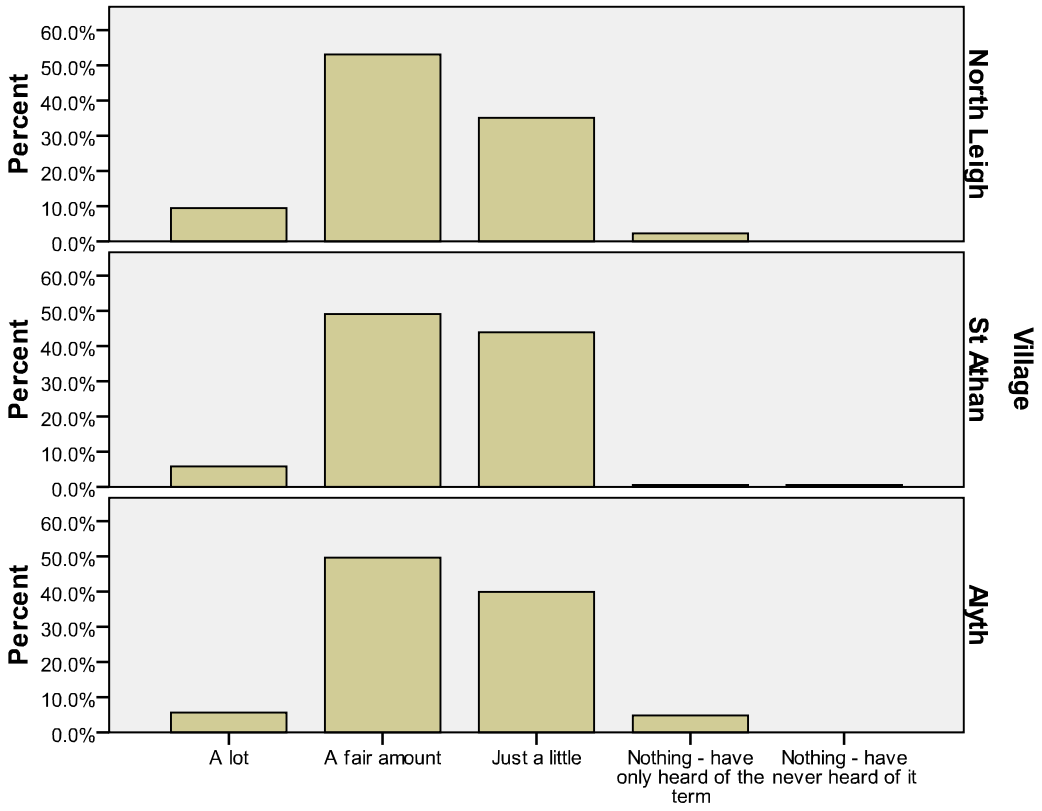
Question 3 (Q3) of the questionnaire asked: *Would you say you are aware of the [name of local programme] project which has been running since [date programme started]?* North Leigh and Alyth were similar in terms of the percentage of respondents

aware of the local energy efficiency programme (90.7% and 87.9%, respectively), as demonstrated through a non-significant chi-square test (χ^2 (1) = 1.169, p= .279).[163] However, only 56.5% of St Athan respondents indicated awareness of the 'Get Smart' programme, which was significantly different from both North Leigh (χ^2 (1) = 55.435, p< .001) and Alyth (χ^2 (1) = 70.509, p< .001). In both North Leigh and Alyth, qualitative findings show most respondents mentioned seeing advertisements for the programme in the local paper, which was verified by the local organising group. In St Athan, the one respondent in the focus group indicated seeing advertisements on television. However, there was no indication that 'Get Smart with St Athan' advertised on television, indicating at least a partial lack of specific awareness of the programme on the part of the respondent. It appears that awareness was higher for the groups which were already established (North Leigh and Alyth), rather than formed for the specific purpose of the intervention (St Athan). This may lend justification to the use of change agents, i.e. individuals (or organisations, such as SSE) who attempt to influence "clients' innovation-decisions in a direction deemed desirable by a change agency" (Rogers 2003, p.366).

[163] Chi-square test was conducted in Excel.

Question 6 of the questionnaire asked: *How much, if anything, would you say you know about energy efficiency?* There does not appear to be great differences between communities (Figure 8-11), with the majority in each village claiming to know 'a fair amount', followed by 'just a little' about energy efficiency.

Figure 8-11: Self-reported knowledge of energy efficiency (percent)



However, Mann-Whitney tests indicate that there were significant differences between North Leigh and Alyth (U=46168.0, p<0.05), though it is not immediately evident why this is so. The qualitative findings indicate that at least one local resident in each community indicated that they would trust 'myself' for information. This could mean that those respondents feel they have a good level of energy efficiency knowledge. But no further evidence in respondent knowledge arose from the focus groups. Further, as described in Appendix J, significance tests from Spearman's correlational coefficient calculations indicated that respondents who reported *lower* levels of energy efficiency knowledge were able to access *fewer* people for advice or information; conversely, this means that respondents who reported higher levels of energy efficiency knowledge tended to be able to access information from *more* people. This was consistent across all three communities, and appears to be in contrast to the findings from the pre-test, which suggested that people might consider themselves so knowledgeable that they would not think to approach anyone for information, were self-sufficient in knowledge,

or did not trust the answers from others. However, these findings may also indicate that self-reported knowledge was actually *gained* from the people referred to in the Energy Efficiency Resource Generator. Further research would be necessary to understand the timing effects and direction of influence.

8.3.6 Adoption of energy-reducing innovations

The questionnaire was designed to elicit information on four different categories of innovations: Walls, windows, doors & floors (WWDF); Visual displays of energy use (Visual); Appliances, heating & lighting (AHL); The way we act in the house (Behave). As the frequency tables in Appendix J demonstrate, there were two innovations, in particular, which seemed to have already diffused through the communities: loft insulation (with reports of adoption *before* the intervention of 62.6% in North Leigh; 61.3% in St Athan; 62.6% in Alyth) and double glazed windows (with reports of adoption *before* the intervention of 80.2% in North Leigh; 77.4% in St Athan; 71.6% in Alyth). These innovations were not promoted as heavily during the interventions, probably due to the fact that the findings correspond to Government statistics (DECC 2010b) and have thus largely diffused through society. SSE were focusing on less popular innovations such as cavity wall insulation and visual displays of energy efficiency information, i.e. smart meters.

Regarding the measurement of the innovation-decision process, the questionnaire was designed to measure all of the stages of the innovation-process for technical innovations (i.e. Walls, windows doors & floors; Visual displays of energy use; and Appliances, heating and lighting). However, the results showed that respondents' answers were clustered around the 'adopted' categories and the 'did not consider' category, with far fewer respondents indicating being in the 'middle' stages (e.g. 'still deciding' or 'planning to order') of the innovation-decision process (see Appendix J for frequencies and proportions of each category). Attempts were made to aggregate the middle categories, but ultimately, the most statistically valid results[164] and most theoretically useful, were derived from the two aggregated categories, 'adopted after intervention' and 'not (yet) adopted' which aggregated the middle stages and 'did not consider'. It must be noted that as those who adopted before the intervention were omitted, it is possible that those who have 'not adopted' could have adopted previously. This is thus more correctly 'not adopted during the time of the intervention'. However, no single innovation was ever considered on its own. As indicated in Table 8-9, if at least one innovation was adopted after the intervention, that respondent was

[164] Due to low frequencies, the expected frequencies necessary for chi-square tests were insufficient (i.e. > 20% of cells had expected frequencies less than 5) to produce valid models (Field 2005).

considered an adopter. The purpose is to understand if householders were influenced by the intervention. This coding thus only excludes all those who adopted *all* innovations before the intervention. The final variable for each innovation category was thus one dichotomous variable (i.e. adopted after intervention / not (yet) adopted) which measured *adoption* of energy-reducing innovations.

Table 8-9: Aggregated variables used to measure adoption

Innovation category	Adopted after the intervention	Not (yet) adopted	Omitted
Walls, windows, doors & floors (WWDF)	At least one item is ticked for 'Installed after [date of intervention]'	All items ticked were either 'Have ordered it', 'waiting for installation'; 'planning to get'; 'considered and still deciding'; 'considered but decided against'; 'did not consider'	Installed before [date of intervention] and missing data
Visual displays of energy use (Visual)	At least one item is ticked for 'Is now installed or already did'	All items ticked were either 'Already installed, but stopped using', 'have ordered it', 'waiting for installation'; 'planning to get'; 'considered and still deciding'; 'considered but decided against'; 'did not consider'	Missing data
Appliances, heating & lighting (AHL)	At least one item was ticked for 'Installed after [date of intervention]'	All items ticked were either 'Have ordered it', 'waiting for installation'; 'planning to get'; 'considered and still deciding'; 'considered but decided against'; 'did not consider'	Installed before [date of intervention] and missing data
The way we act in the house (Behave)	At least one item scored 'better' in the 'past week' than before [date of intervention]	Did not score 'better' in the 'past week' than before [date of intervention]	Missing data

The frequencies (and percents) of these aggregated categories are presented in Table 8-10.

Table 8-10: Frequencies (percents) of adopter categories

	North Leigh (N=227)	St Athan (N=186)	Alyth (N=479)
WWDF			
Adopted after intervention	**67 (29.5%)**	**45 (24.2%)**	**110 (23.0%)**
Not (yet) adopted	**97 (42.7%)**	**80 (43.0%)**	**187 (39.0%)**
Missing or adopted before intervention	63 (27.8%)	61 (32.8%)	182 (38.0%)
Visual			
Adopted after intervention	**110 (47.6%)**	**53 (28.5%)**	**115 (24.0%)**
Not (yet) adopted	**108 (48.5%)**	**104 (55.9%)**	**292 (61.0%)**
Missing	9 (3.9%)	29 (15.6%	72 (15.0%)
AHL			
Adopted after intervention	**142 (62.6%)**	**81 (43.5%)**	**253 (52.8%)**
Not (yet) adopted	**56 (24.7%)**	**68 (36.6%)**	**111 (23.2%)**
Missing or adopted before intervention	29 (12.8%)	37 (19.9%)	115 (24.0%)
Behave			
Adopted after intervention	**152 (67.0%)**	**84 (45.2%)**	**223 (46.6%)**
Not (yet) adopted	**71 (31.3%)**	**92 (49.5%)**	**236 (49.3%)**
Missing	4 (1.8%)	10 (5.4%)	20 (4.2%)

8.3.7 Accessible 'energy social capital'

Accessible 'energy social capital' was measured using a bespoke resource generator, here called the Energy Efficiency Resource Generator, which aimed to ask about resources that were potentially available to respondents. Overall, averaged across the twelve items of the Energy Efficiency Resource Generator, 54.7% of North Leigh respondents indicated access to any energy efficiency resources; 45.3% of St Athan residents reported access to any energy efficiency resources; and 57.9% of Alyth respondents reported access to any energy efficiency resources. Compared with another 'general' social capital resource generator, the SSND,[165] which was used in The Netherlands, these scores are quite low: the SSND found that an average of 76% of respondents had access to resources (van der Gaag & Snijders 2005). However, the Energy Efficiency Resource Generator, by definition, is measuring a very specific field of resources, where as van der Gaag & Snijders (2005) were attempting to measure general resources that range across many domains of life and are usually highly accessible. Therefore, the discrepancy is not unexpected, and it may be considered even quite good that around 50% of people personally know someone whom they can approach for information – however, there is nothing with which to compare this, so it is only speculation.

In each village, the most popular item was *'... knows a lot about DIY'*, which is the one item which was taken from another British-based resource generator called the RG-UK (Webber & Huxley 2007).[166] In North Leigh, 75.5% knew someone who knew a lot about DIY; in St Athan, 71.6% knew someone and in Alyth, it was 74.6%. Webber & Huxley (2007), by comparison, found that 83.1% knew someone who 'knows a lot about DIY' (p.488). The least popular item in the Energy Efficiency Resource Generator was also consistent across the three case study communities: less people knew anyone who *'...can explain the pros and cons of having a smart meter installed'* than any other item (38% in North Leigh; 29.5% in St Athan; and 42.1% in Alyth). This finding has particular relevance to the SSE and future smart meter interventions.

The Energy Efficiency Resource Generator was evaluated for homogeneity, i.e. to see if the 12 items created a single scale, using MSP 5 for Windows (Molenaar & Sijtsima 2000).[167] The results, as summarised in Appendix J, indicated a high degree of

[165] Survey of the Social Networks of the Dutch (SSND), collected in 1999-2000 (van der Gaag & Snijders 2004a)
[166] Resource Generator UK (RG-UK) was constructed by Webber & Huxley (2007) to measure general social capital.
[167] MSP 5 for Windows uses exploratory non-parametric item response theory, which is a method that parallels exploratory factor analysis, but can handle ordinal and dichotomous data (van der Gaag 2005; Webber & Huxley 2007).

homogeneity across all 12 items in North Leigh and St Athan and across 11 items in Alyth, all with very high corresponding reliability scores (i.e. ρ =.9 or above). These results indicate that all the items fit well as a unified scale, with the one exception of the question (Q7f) in Alyth, i.e. "*...is an electrician or works directly with electrical equipment*." There are no real comparisons to make for this Energy Efficiency Resource Generator, but the rho (ρ) scores do provide evidence of a high degree of reliability, as well as internal validity. The Energy Efficiency Resource Generator was generally used here to test the method, and results are compared to mobilised 'energy social capital' in Hypothesis 4. In future, it may be that this quickly administered measurement tool could help practitioners understand the availability of energy information in householders' social networks.

8.3.8 Mobilised 'energy social capital'

Mobilised 'energy social capital' was measured by posing questions regarding whether the respondent had spoken to anyone about a set of innovations. For example, Question 9 (Q9) for the WWDF innovation category asked: *From time to time, people discuss matters with others to get information. Thinking about insulation, draught-proofing or double/secondary glazing of windows, as above, did you discuss these with anyone to get information since [date of intervention]?* There were four innovation categories, so four opportunities for asking about mobilised 'energy social capital'. Respondents could list up to three people for each category, yielding the ability to name up to 12 separate alters. In North Leigh, about 54% of respondents indicated speaking to at least one person. In St Athan, about 41% of respondents indicated speaking to at least one person. And in Alyth, approximately 47% of respondents indicated speaking to at least one person. However, almost no respondents named more than six different alters with whom they had spoken about energy efficiency (with the exception of 3 in respondents in Alyth who listed up to nine), and the frequencies dropped dramatically after three alters (see Appendix J for frequencies). Overall, it seems that there was an initial threshold of 3 people to speak to, and a maximum of 6, which may be due to the nature of the questionnaire (which asks for names in multiples of three's), and also could be due to a cognitive load limit (Lin & Belkin 2005). Further investigations of mobilised 'energy social capital' are addressed in Hypotheses 5 (H5) and H5a-e, below.

8.4 Case study findings

Quantitative results using inferential and descriptive statistics from the self-completion questionnaire are presented here. They are then evaluated in the context of the

qualitative findings from the focus groups, in the form of anonymised statements quoted from focus group participants.

8.4.1 Research Question 1: accessible 'energy social capital'

The first research question asks:

> **Research Question 1**: What are the features of the communication structure, and specifically the accessible 'energy social capital', in the diffusion of energy-reducing innovations?

There were three hypotheses developed to address the research question regarding accessible energy social capital.

8.4.1.1 Hypothesis 1

The first hypothesis was:

> **H1**: Householders will report that they would be just as likely to access 'energy social capital' as informational sources from non-interpersonal contacts.

The likelihood in contacting personal contacts, as compared to media sources or organisations, was assessed using one question (Q5) which asked: *If you had a question about energy use in your home, what would be the FIRST thing you'd do to get information?* The results are presented in Table 8-11.

Table 8-11: Question 5 (Q5): What would be the FIRST thing you'd do to get information?

	North Leigh			St Athan			Alyth		
	N	%	Valid %[a]	N	%	Valid %[a]	N	%	Valid %[a]
Ask someone I know	68	30.0%	**30.9%**	64	34.4%	**37.4%**	163	34.0%	**35.5%**
Check media sources	75	33.0%	**34.1%**	57	30.6%	**33.3%**	123	25.7%	**26.8%**
Approach an org/group	77	33.9%	**35.0%**	50	26.9%	**29.2%**	173	36.1%	**37.7%**
Missing	7	3.1%		15	8.1%		20	4.2%	

[a] Valid percent does not include missing data

A chi-square (χ^2) test for one-sample is used to compare expected frequencies of a single variable with more than two categories (Bryman & Carter 2001).[168] As it was expected that there would be an equal distribution between categories, the expected frequencies were designated as such (i.e. one-third of expected values for each category). The results indicate that no significant differences from the expected frequencies were found in North Leigh ($\chi^2(2)=0.609$, $p=.737$) or St Athan ($\chi^2(2)=1.719$, $p=.423$). However, in Alyth, the frequencies were significantly different from the expected values ($\chi^2(2)=9.150$, $p<.05$). It appears that respondents in Alyth were far less

[168] The chi-square test for one sample is similar to the binomial test, explained in 8.4.1.2, but for variables with more than two categories.

likely to check media sources. However, Mann-Whitney tests found no significant differences between North Leigh and St Athan (*U*=17624.5*, p*=.139), North Leigh and Alyth (*U*=49918.0*, p*=.799) or St Athan and Alyth (*U*=36637.5*, p*=.173).[169]

In North Leigh, the qualitative findings for this hypothesis generally tend to reflect the fact that people would seek, or more generally find, information from either of the three options.[170] A few respondents indicated that they would consider approaching someone they knew.

> R19(NL):"Depending on what it is, I would probably go and have a word with R7 (NL) first, because he's there.
> R18(NL): He's your neighbour.
> R19(NL): He's my neighbour, yeah." (North Leigh, Residents Focus Group 3)

Some respondents also often mentioned getting information either from the general media, through television or radio, or through the local paper, the Nor'Lye News.

> R7 (NL): "You can hardly ever turn the radio or the television on now or read a newspaper without something of world significance on the matter of climate change." (Challenge North Leigh focus group)

> R18(NL): "Yeah, I mean whenever it started I can remember seeing something in the Nor'Lye News, which is our North Leigh bible, and I think I probably, I glazed over the first time. Then it was repeated. So then you begin to think well there might be something in it." (North Leigh, Residents Focus Group 3)

But then there were also indications that people would not choose these media sources.

> R13 (NL):"And some people don't read newspapers at all." (Challenge North Leigh focus group)

> R7 (NL): "The Nor'Lye news is, we hope, read by a lot of people, I know perfectly well it isn't. A lot of people don't even bother to read it, put it straight in the bin. ..." (Challenge North Leigh focus group)

Some respondents from the Challenge North Leigh focus group indicated that people were likely to approach organisations and members of the Challenge North Leigh group to speak about the issues, and specifically to approach the local SSE adviser (referred to as R8(NL) in qualitative findings), who was working in the village and lived in a nearby village, for advice (see last comment).

> R11 (NL)[171]: "Yeah, the Green Fair, so we actually came up to have a look at the Green Fair to see what it was all about. And that actually drew us in from outside." (Challenge North Leigh focus group)

[169] It is acknowledged that the order of the answer categories may have influenced the response, something that is generally known as the "response order effect" (Groves et al. 2004). In questionnaires, the primacy effect means there is a tendency to select the first answer category. However, the very slight (non-statistically significant) variation in responses between communities of 'ask someone I know' which did not all favour the first answer, as well as the equal answer across categories, seems to indicate that this may not have had a strong effect here.
[170] People did not always 'seek' information, but perhaps came across it by chance.
[171] Uncertain of the person speaking, but believe it is may be this person.

R14(NL): "Well I think I would trust somebody from the company, you know, the electricity company. You can soon find out how knowledgeable he was. I don't know otherwise." (North Leigh, Residents Group 2)

R11 (NL): "I really do think that R8(NL)'s uniform helps people to trust what he says. And when they come up and talk to us, it's like a general talking, isn't it? But when R8(NL), when they talk to R8(NL), R8(NL) is actually advising them and it looks almost, well it is an official capacity. And I think for some people, that has a greater input than us chatting ...." (Challenge North Leigh focus group)

Only one resident participated in the Residents focus group, and he was an engineer who indicated that he trusted his own knowledge.

Megan: "... if you have a question about energy use in your home, who would you trust to give you a good answer? ...
R10(SA): Myself. [laughter]
Megan: Yourself? Okay. You've had lots of training.
R10(SA): I think that is why I trust myself. Because some of the information is, I think biased."[172] (St Athan, Residents Group)

The focus group with the 'Get Smart' members yielded information that indicated that the at least one respondent thought St Athan residents would seek information from people and organisations.

Speaking to people

R9(SA) – "There's no better recommendation and that's why the personal contact's so important, because you can read it on a piece of paper ... you think oh interesting, but when you've actually seen somebody do it, and they say 'eh it's really good', then that's the way it works best, yeah." ('Get Smart with St Athan' focus group)

Approach an organisation

R9(SA) – "We've had a couple of people coming through to the Local, asking the Local Authority from St Athan, not necessarily knowing about this Group though I think though, but just general, you know, I don't know, I probably, we haven't checked, we haven't said, are you doing this because of Get Smart with St Athan or just because you want to get your house insulated, but we've had a few." ('Get Smart with St Athan' focus group)

There was curiously little mentioned about the media in the Get Smart with St Athan group, except for the fact that the group felt that they were being ignored by the media. One respondent mentioned that if they had more attention, St Athan residents would notice and identify with the effort.

R2 (SA): "Yeah, but if they need to switch on the television and saw St Athan was on the news I think people would have been quite excited about it."

In Alyth, chi-square tests showed that the frequencies varied significantly from what was expected. Residents were a bit more likely to approach an organisation or group (37.7%) or ask someone (35.5%) than to check media sources (26.8%). The qualitative findings from a single dialogue with the residents indicates, however, a fairly equal dispersion of actions amongst these people:

[172] The bias the respondent refers to is specifically related to energy derived from wind turbines, rather than energy efficiency, as can be examined in the transcripts in Appendix G.

> Megan: "... if you had a question about energy use in your home who would you trust to give you good information or to give you a good answer?
> R2(AL): The Hydro board, I'd imagine.
> R4(AL): I would look it up on the web.
> R3(AL): My bills, I got a big bill I would panic. I believe my bills.
> R1(AL): I tend to investigate these things myself, so I would read the back of devices and see what the ratings are on motors and pick up manuals and see what energy consumptions are and things like that. I think that is probably more the approach I do, sometimes look things up on the web.
> R4(AL): You might discuss things with other people and say I am doing this what are you doing, but I don't think you would go around to your neighbour and ask their advice." (Alyth, Residents Group)

The perspective from the Alyth Energy Challenge group seemed to be that residents would first notice the campaign, then talk to their neighbours about it, and finally contact the ACAT group, more so than looking at local media sources.

> R10(AL) – "But it's the communication, this communication in the form of talking. ... I think has brought most people on to energy conservation that are now aware of it in Alyth ... More than reading about it in the Alyth Voice" ('Alyth Energy Challenge' focus group)

> R9(AL) –"I would say the most effective thing is when, if you've been in to a house, and you've given advice, and it's always good advice, you know, when it's good advice, that that person then speaks to a neighbour. These are the people that are now drifting in, we're getting taking enquiries from people who were never a part of the initial survey, never filled in the initial questionnaire and did it online or whatever. And now they're speaking to other people in the town ... and now they're coming to us so they can get advice as well" ('Alyth Energy Challenge' focus group)

In order to understand what factors may have an association with the answer categories for Question 5, a number of crosstabulations were performed against other variables from the questionnaire which yield Pearson's chi-square test of significance results. Full results are presented in Appendix K, but two particularly significant sets of results are shown in Table 8-12.

Table 8-12: Results of Pearson's chi-square tests of where *find information first* (Q5) and other variables

	North Leigh			St Athan			Alyth		
	χ^2	***df***	**Sig**	**χ^2**	***df***	**Sig**	**χ^2**	***df***	**Sig**
Education (Q46)	17.969	4	0.001**	13.177	4	0.010**	33.898	4	0.000***
Age of respondent (Q45)[a]	24.297	4	.000***	21.637	4	.000***	54.892	4	0.000***

*p<.05, **p<.01, ***p<.001
[a] Recoded into three categories: 16-44, 45-64, 65+

The chi-square tests indicated that, in each community, there was a significant association between Question 5 (where respondent would seek information first) and reported education level (Q46), which is represented graphically in

Figure 8-12 (frequencies are reported in Appendix K).

Figure 8-12: Education qualifications according to where find energy information first (percent of respondents in each community)

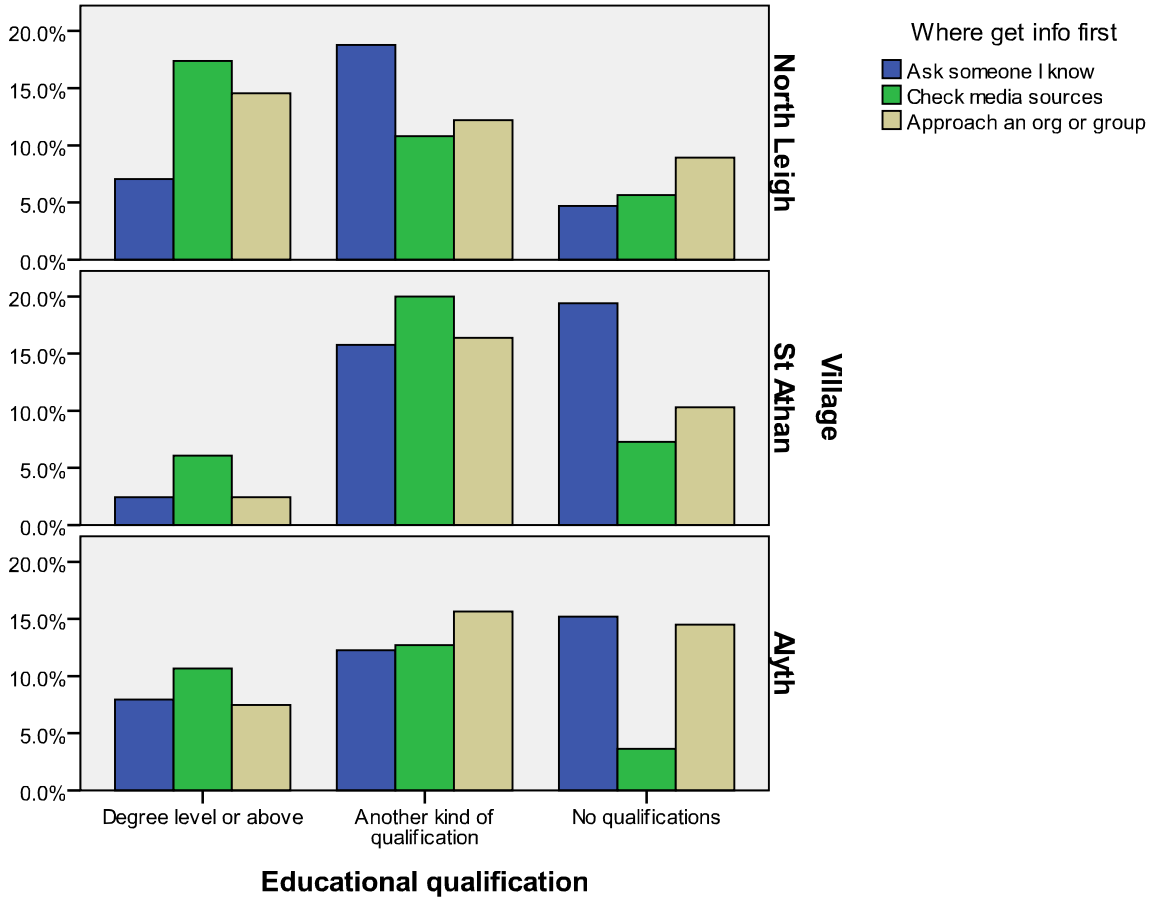


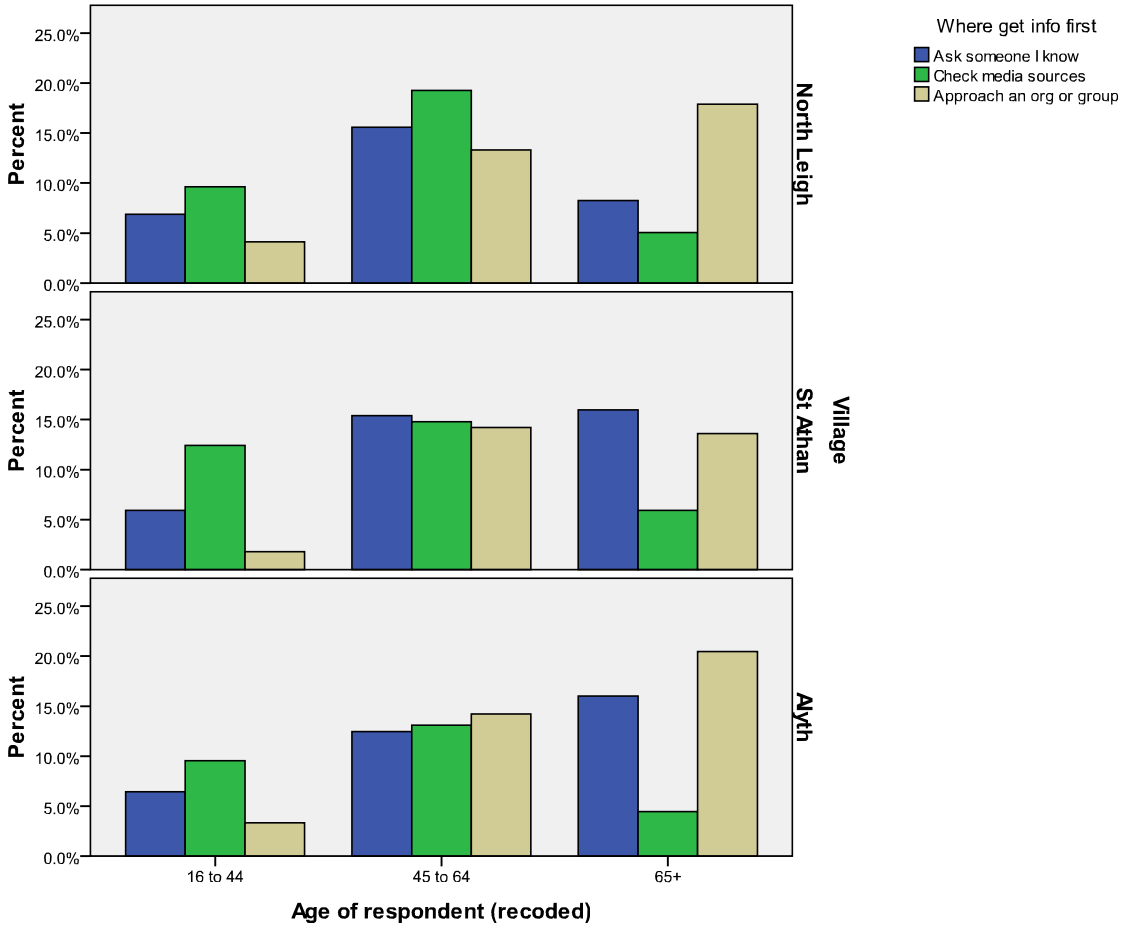
Figure 8-12 illustrates the differences, which are all significant according to the chi-square tests, between the education level of the respondent and where respondents indicate they would first go for energy efficiency information. All three villages show a slight preference for checking media sources amongst those who achieved degree level or above, a mixture of preferences amongst those with another kind of qualification, and much less of a preference for checking media sources amongst those with no qualifications in St Athan and Alyth. There is little in the qualitative data to contextualise these findings. Social capital theory indicates that those with more education and income tend to have better access to social resources (Johnson 2005), so it might be assumed that higher education would lead to higher levels of reported accessible 'energy social capital'. However, there is also evidence from Information Interchange Theory[173] which indicates that "better educated respondents tended to be more critical of their own capacity to locate high-quality information and more

[173] The Theory of Information Interchange "focuses on the importance of considering the roles and aims of both the information provider and the information user in assessing the effectiveness of, and potential improvements to, the information communication process" (Marcella & Baxter 2005, p.204).

discerning about the limitations of the sources that were available to them" (Marcella & Baxter 2005, p.208). This implies that better educated respondents may be critical of unreliable information from friends, perhaps preferring to speak with experts or professionals.

There was also a significant association between Question 5 and the reported age of the respondents in each community, as show in Figure 8-13 (frequencies are reported in Appendix K). Age was re-coded in each case, due to the low frequencies in the lowest and highest age categories.[174]

Figure 8-13: Age ranges according to where respondents would find information first (percent of respondents in community)



In each village, those in the youngest age category were more likely to check media sources. As this category collapses two other categories, it is very wide ranging (i.e. includes ages 16 to 44), and will surely lack precision due not only to the result of combining two age categories, but also to the wide range in the original answer categories. Regarding the next age group, those aged 45 to 64, there were slightly

[174] Categories 16-25 years and 26-44 years were combined into one category, 16-44 years and 65-74 years and 75+ were combined into one category, 65+.

different findings in each community. In North Leigh, respondents in this age group were slightly more likely to check media sources. In St Athan, respondents demonstrated an almost equal preference for where to get information first. And in Alyth, respondents had a slight preference of approaching an organisation or group first, though this was closely followed by checking media sources, which was also closely followed by asking someone. For those 65 years and older, respondents in North Leigh and Alyth were more likely to approach an organisation, while those in St Athan were slightly more likely to ask someone they knew. One trend is that respondents in the oldest age category (65+) were much less likely to check media sources across all three communities. In the questionnaire, the 'media' answer category was followed by examples: Internet, followed by newspapers, magazines, radio or television. As respondents across all three communities, and seemingly regardless of age, mentioned reading their local papers,[175] it is perhaps other media sources, such as the internet, where differences arise, particularly as the placement of 'the Internet' in the answer category may have contributed to a primacy effect.[176] If this were the case, it could be that those aged 65+ were less likely to use the Internet and other information and communication technology (ICT), consistent with the literature (Gilleard & Higgs 2008). Therefore, this finding, with respect to the internet answer category, may not be unexpected, but further research would be necessary to verify this claim.

In general, the findings from North Leigh and St Athan confirmed the hypothesis, based on chi-square test for one sample, but Alyth did not (summarised in Table 8-13). The Mann-Whitney tests indicate the question holds a high degree of validity and reliability, due to similarly repeated results. The results for North Leigh and St Athan, in particular, were very similar to Johnson's (2004) findings that people were just as likely to contact other people as they were to use organisational or media resources when searching for information. Current emphasis from Government is providing information via media sources and organisations (Wallace et al. 2010), which would account for approximately two-thirds of information-seeking behaviour in the research populations, but may be overlooking the remaining one-third.

The results may be a disappointment for those who believe social networks are more important than other forms of communication; Darley & Beniger (1981) discussed the

[175] In St Athan, this was not recorded, but was mentioned by members of each group before and after the recordings.
[176] The primacy effect is the "tendency to select from among the first answers presented" (Dillman 2000, p.64)

use of social networks for the diffusion of energy-conserving innovations and claimed that:

> "... innovators should report that interpersonal sources of information are more *important* in encouraging them to innovate than either public interest governmental appeals, communicated via mass-media, or private sector advertising disseminated in the same fashion" (p.168, emphasis added).

Many of the respondents here would not necessarily be innovators (i.e. the first to adopt an innovation), but could instead be part of the majority of adopters, so theoretically may not be as reliant on social networks. The *importance* of interpersonal information may arise in actually confirming messages heard elsewhere. Granovetter (1973) reports that "…studies of diffusion and mass communication have shown that people rarely act on mass-media information unless it is also transmitted through personal ties" (p.1374). Though 'importance' was not actually measured in this survey, the general findings indicate that personal resources were as likely to be considered when *first* looking for information as media or organisational resources. It must be noted that the answers may have been quite different if this was an open-ended question, or more answer choices were given. The results may also change if respondents were asked who they would seek information from in the second or third instance, when they may be seeking to confirm the first bit of information, or at different points of the innovation-decision process.

Table 8-13: Hypothesis 1 confirmed?

Hypothesis	North Leigh	St Athan	Alyth
H1: Householders will report that they would be just as likely to access 'energy social capital' as informational sources from non-interpersonal contacts.	Yes	Yes	No

8.4.1.2 Hypothesis 2

The next hypothesis regarding accessible 'energy social capital' involves understanding whether community members were considered sources of energy efficiency information.

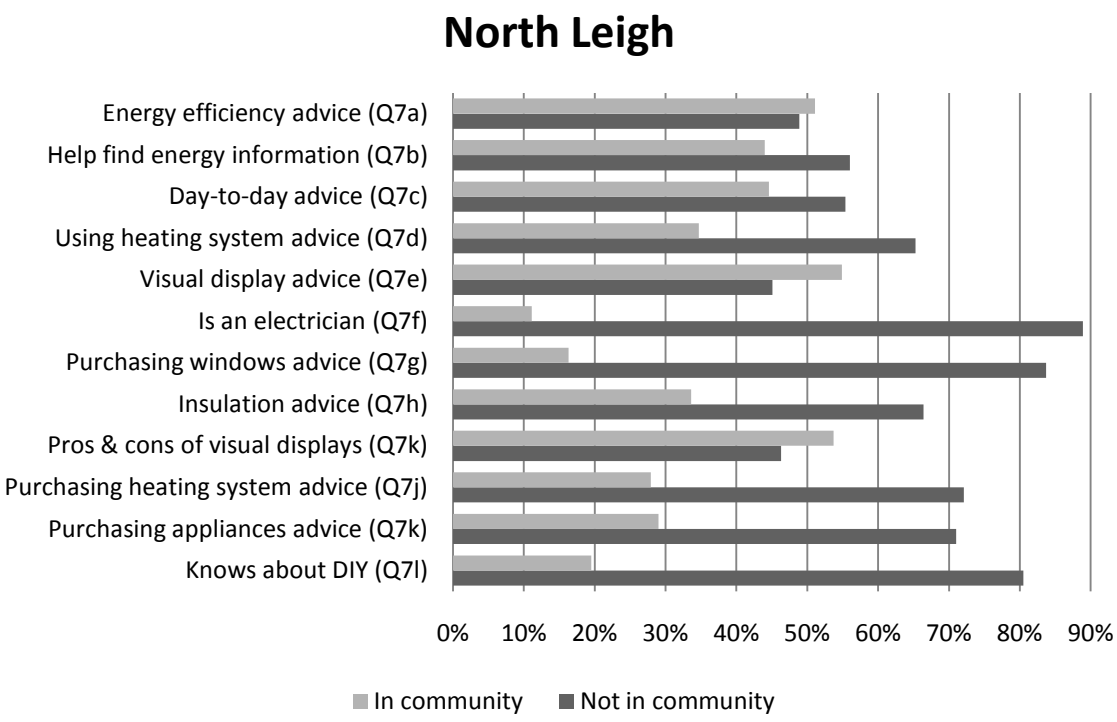
> **H2**: Householders will be more likely to report accessible 'energy social capital' with contacts living in the same geographic community.

In order to determine which contacts lived in the same community, the frequencies of the Energy Efficiency Resource Generator categories 'neighbours' and 'in [village/town] but not immediate neighbours' were examined. The percentage of respondents who indicated they could access 'energy social capital' through those in the community was assessed by summing the total numbers who ticked each of the two items and

aggregating the answer categories into 'In Community'. Then the remaining answer categories, 'immediate family', 'wider family', 'friend', 'colleague', and 'acquaintance' were aggregated into a new category called 'Not in community'. The full list of responses to the Energy Efficiency Resource Generator are in Appendix J.

Across the twelve questions of the Energy Efficiency Resource Generator, as in Figure 8-14,[177] the percentage of respondents in North Leigh who indicated that they knew someone to ask for information *within the community* ranged from 19.5% to 54.9%, depending on the information resource. The percentage of respondents who indicated that they knew someone to ask *outside of the community* of North Leigh ranged from 46.3% to 88.9%.

Figure 8-14: Percentage of respondents in North Leigh who would seek information within the community



The only resources which respondents indicated being more able to access from others within the village were 'sound energy efficiency advice' (Q7a), 'visual display (i.e. smart meter) advice' (Q7e), and 'pros and cons of visual displays' (Q7k). Binomial tests of significance were used to assess whether or not the observed frequencies significantly differed from the expected frequencies. Binomial tests of significance are based on Equation 3, which seeks to find the probability of getting *r* observations in one category, as compared to *n*-*r* observations in the other category, based on the total number, *n*. The *p* is the probability of more observed frequencies in the first category

[177] This figure displays valid percents, i.e. missing data is not included.

and *1-p* is the probability of more in the second category. *N* is the number of times *n* units are taken by *r* times (Clarke & Cooke 1978). All tests were performed in SPSS 17.0.

Equation 3 (from Clarke & Cook 1978, p.256)

$$p(r)binomial = N_r^n * p^r * 1 - p^{n-r} = (n!\, p^r (1 - p^{n-r}))/(r!\,(n-r)!)$$

As the hypothesis indicates that respondents are more likely to access 'energy social capital' from people within the same community, the binomial tests performed in SPSS 17.0 compared responses to a 50% expectation. The results of the binomial tests (see Appendix K) indicate that though slightly more people spoke to people within the community regarding 'sound energy efficiency advice' (Q7a), it was not significantly more. But there were significant differences in Q7e and Q7k. The variables Q7e and Q7k regarded two relatively new innovations which were only being deployed at the community level of North Leigh, and as this community also had a very active and established energy efficiency group, the significant findings in the direction of 'in community' are not unexpected.

However, binomial tests also indicated that four other variables (Q7b, Q7c, Q7e and Q7i) also did not significantly vary from the 50% benchmark, meaning that even though more people spoke with people *not* in the community for those variables, it was not significantly more.

The qualitative evidence from North Leigh suggests that those in the focus group tend to trust their neighbours, and particularly one person in the village (referred to as R7(NL)) who was instrumental in starting the energy efficiency campaigns in the village.

> R1(NL): "I'd probably trust a neighbour. So having, having met these people who have lived in the same village of them for six years but I haven't met them yet. I'd probably trust these people. I'd probably trust local people who live close to me, and who have the same kinds of concerns and irritations. Or R7 (NL), who's got tremendous interest and enthusiasm." (North Leigh, Resident Focus Group 1)

> R5(NL): "But it's come back to basics, like trusting your neighbour for advice.
> R1(NL): Yeah.
> R4(NL): But in the village that's more likely to occur, isn't it? There is a certain sort of bonding in villages as opposed to towns, I'm sure." (North Leigh, Resident Focus Group 1)

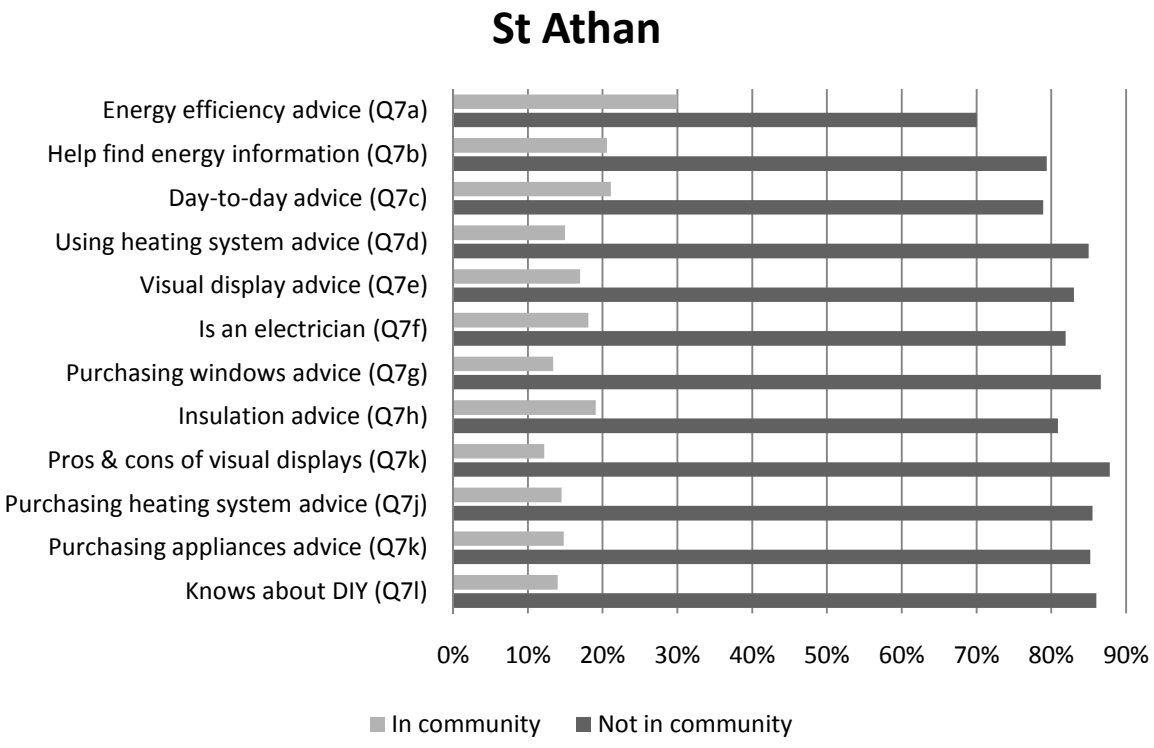
But there are also suggestions that focus group members might not think to ask many people within the community unless it was made very obvious to them that there was information available.

R19(NL) – "Apart from speaking to [my neighbour] R7 (NL), because he'll probably bring the subject up to me, there's nobody outside I would talk to or probably think at all about it." (North Leigh, Resident Focus Group 3)

R11 (NL)[178] – "Yeah, the Green Fair, so we actually came up to have a look at the Green Fair to see what it was all about. And that actually drew us in from outside. If it hadn't been there I don't suppose that we would have done anything about it, because we were just right at the end of the village." ('Challenge North Leigh' focus group)

In St Athan, as in Figure 8-15, at least 70% ('sound advice on energy efficiency') and up to 88% (explain the pros and cons of having a smart meter installed) of respondents said they knew people to approach for information with people who did *not* live in St Athan. The percentage of respondents who indicated that they knew someone to ask for information *within the community* ranged from 12.2% to 21.1%. These ranges are markedly different from North Leigh and Alyth. Binomial tests revealed that all variables varied significantly from the expected frequencies, which used a 50% benchmark (see Appendix K contains all results).

Figure 8-15: Percentage of respondents in St Athan who would seek information within the community



The qualitative findings only vaguely suggest that a couple respondents in the focus group would turn more toward family members or colleagues.

Megan: "Who do you speak to about that? Your family or friends?

[178] Uncertain if this was definitely the person who said this, as voices were difficult to distinguish in the recordings.

R10(SA): Well, it's family isn't it. It's got to be." (St Athan, Resident focus group)

R2 (SA): "We got dragged along to one of the first meetings 'cause R1 (SA) worked with somebody who was already on the Committee or had gone along to meetings, so you got approached in a corridor in work." ('Get Smart with St Athan' focus group)

R2 (SA): "I do tend to talk about it a bit more, I've recently started a new job and I now travel round the country visiting firms ... and it does come up on the back of data protection, so you end up with data protection and shredding confidential waste, which then leads into where does your other paper waste go, well where does your recycling go, well where does your energy efficiency, there's a long chain, but yeah." ('Get Smart with St Athan' focus group)

It may be that the reliance on family members and work colleagues indicates that the contacts of these respondents do not live within the village of St Athan. In the questionnaire, respondents were told to 'tick as many as apply' when answering the Energy Efficiency Resource Generator. Respondents thus had the option to tick both their immediate family as well as 'In [community]' if they lived with their immediate family (and if they interpreted the question as different ticks applying to one person). However, responses raised questions as to whether or not respondents would do this, as H3 (which will be discussed next) indicated a strong preference for St Athan respondents to approach family and friends. If a respondent lives with a family member (who is necessarily in the same community), but did not tick 'Neighbour' or 'In [community]', the results would *not* account for everyone within the community. In order to understand this, each of the twelve Energy Efficiency Resource Generator questions was examined via crosstabulation with the answer category 'Immediate family' for each item in each village. If respondents indicated that they could access 'energy social capital' with immediate family, and believed that they should also tick 'in community' if they lived with that person, for example, then there would logically be higher instances of respondents ticking both 'yes-immediate family' and 'yes-in community'. Looking at the data, a minority of responses, i.e. as little as 0% in St Athan but as many as 26.7% in North Leigh, ticked both 'immediate family' and 'in [community] but not immediate neighbour'. Table 8-14 is an example from the SPSS output of purchasing appliances.

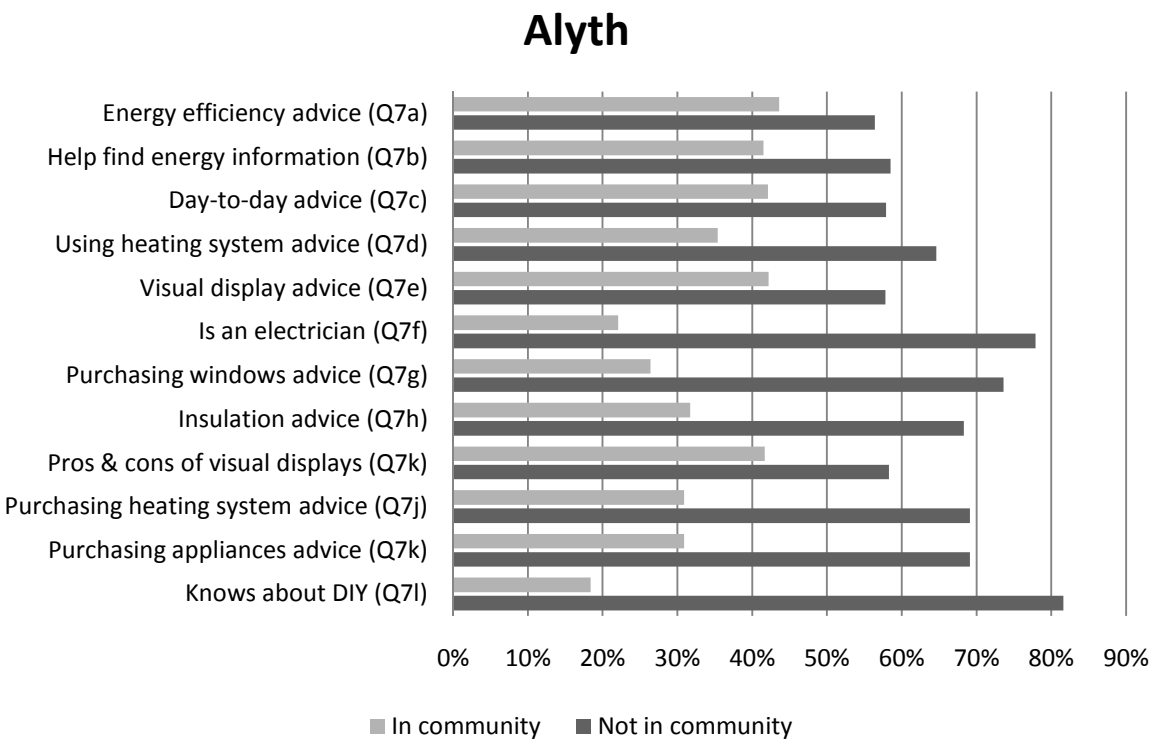
Table 8-14: Appliance purchasing * Immediate family * Village crosstabulation (frequencies)

			Immediate Family (Appliance)		
Village			No (not ticked)	Yes (ticked)	Total
North Leigh	Appliance	Not in community	41	35	71
		In community	20	**4**	29
	Total		61	39	100
St Athan	Appliance	Not in community	29	27	52
		In community	5	**0**	9
	Total		34	27	61
Alyth	Appliance	Not in community	92	67	150
		In community	52	**6**	67
	Total		144	73	217

The speculated reason for the low frequency of this category is that the question '*in [community], but not immediate neighbour'*, as placed next to (and in possible assumed opposition to the) '*neighbour'* category, would likely be interpreted as encompassing people who, for example, lived a few streets away from the respondent, instead of those in the same household. This means that there are large uncertainties surrounding the location of immediate family, and also possibly friends (if flatmates, for example, are considered friends). Assuming that immediate family members would more often live in the same household than not, it is speculated respondents may not be ticking 'all that *really* apply'. The results lead the author to believe that respondents are *not* including family members in the same household in the 'in [community], but not immediate neighbour' category, which means the results could be under-representing those in the same community, which raises questions about the content validity of the conclusions here.

In Alyth, like in St Athan, there were no categories in which people would approach more people within the community, than outside of it, and binomial tests revealed that frequencies were significantly different from expected frequencies for all 12 questions. However, there were also more indications of being able to speak to people in the community for advice, as compared to St Athan. The percentage of respondents who indicated that they knew someone to ask for information *within the community* ranged from 18.4% (i.e. knowing anyone in the town to approach who knew a lot about DIY) to 43.6% (i.e. knowing anyone in the town that could offer sound advice on energy efficiency). The percentage of respondents who indicated that they knew someone to ask *outside of the community* of Alyth ranged from 56.4% to 81.6%. Like St Athan, binomial tests revealed that all variables varied significantly from the expected frequencies, which used a 50% benchmark (see Appendix K contains all results).

Figure 8-16: Percentage of respondents in Alyth who would seek information within the community



The qualitative evidence suggests that there are instances where respondents do not seek information from neighbours:

> R4(AL): "You might discuss things with other people and say I am doing this what are you doing, but I don't think you would go around to your neighbour and ask their advice." (Alyth, Resident focus group)

But there are indications that they might seek information from someone they know or believe is part of the Alyth Energy Challenge (or ACAT group).

> R5(AL) – "Certainly now you, do see the local people and they, they stop [you] in the street. Based on the logo on the shirt. So ... there is penetration there now. You'd have to say probably better than it was before." ('Alyth Energy Challenge' focus group)

The reliance on a specific individual in North Leigh and those with branded ACAT logos in Alyth suggests that people will seek information from community members, and perhaps more so if they are considered knowledgeable or to be part of an initiative. These findings are similar to those which Weenig (1993) found: "... we may conclude that the personal networks of the paraprofessionals play an important role in the information diffusion process of a community communication program and thus in its ultimate success" (p.1728). The paraprofessionals, or intermediaries, whom they reference were local residents who had been trained in energy efficiency as part of Weenig's (1993) research experiment, giving the group members a level of expertise which may have increased confidence in their messages (Shipworth 2000), similar to

the methods used in the three communities in this research. The quantitative findings in North Leigh particularly reflect this, with the higher percentage of respondents who indicated they would ask someone in the community about the interventions being deployed only *within* North Leigh. North Leigh also had the benefit of having a dedicated adviser from SSE who not only worked in the library in the village, but also lived locally (not in North Leigh, but in a neighbouring village).[179] These findings indicate that when asked where they would seek information, it generally would not be within the village, unless perhaps it was to speak to a type of 'paraprofessional'. However, it must be noted that the Energy Efficiency Resource Generator evokes hypothetical situations which might be more indicative of what respondents would *think* they would do in the first instance. As noted in Hypothesis 5d below, residents may need to seek information from multiple sources, and these could include neighbours.

The quantitative findings did not confirm the hypothesis, as summarised in Table 8-15, but qualitative evidence did indicate a particular reliance on local experts, or 'intermediaries,' for sources of local information. However, as noted above, there are serious questions regarding the content validity of the answer categories of the Energy Efficiency Resource Generator, which will affect the conclusion validity.

Table 8-15: Hypothesis 2 confirmed?

Hypothesis	North Leigh	St Athan	Alyth
H2: Householders will be more likely to report accessible 'energy social capital' with contacts living in the same geographic community.	No (Perhaps invalid)	No (Perhaps invalid)	No (Perhaps invalid)

8.4.1.3 Hypothesis 3

Hypothesis 3 concerns the 'strength of tie' the respondent has with a potential source of information on energy-reducing innovations:

> **H3**: Householders will indicate that accessible 'energy social capital' is available more through weak ties than through strong ties.

Strong ties have been defined as encompassing immediate family, wider family and friends (Lin & Dumin 1986; Harshaw & Tindall 2005). Weak ties have been defined as including neighbours, those in the same geographic community who are not neighbours, colleagues, and acquaintances (Murray et al. 1981; Harshaw & Tindall 2005; Wellman 1979; Johnson Brown & Reingen 1987).[180] The full list of responses to

[179] St Athan also had an SSE adviser, but was only present for a couple months prior to the focus group and the feedback from his involvement was uncertain.

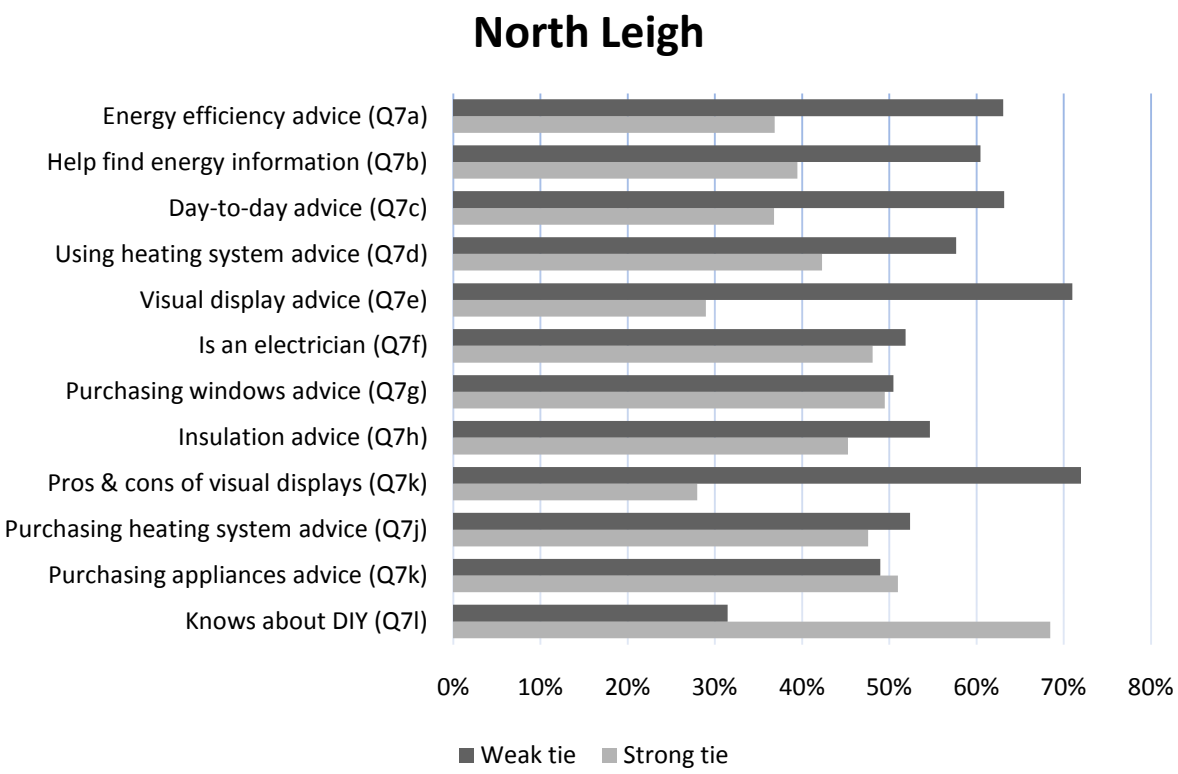
[180] Colleagues was not found in the literature, but were assumed to be weak ties. Neighbours were sometimes considered strong ties (Lin et al. 1981), and sometimes considered weak ties (Wellman 1979). Johnson Brown & Reingen (1987) had two types of neighbours: those who the respondent indicated were

the Energy Efficiency Resource Generator according to each type of tie, before aggregation, is found in Appendix J. The percentage of respondents who indicated they could access 'energy social capital' through weak or strong ties was assessed by summing the total numbers who ticked each item of the resource generator, and combining the answer categories and coding as either strong or weak ties. As respondents were encouraged to 'tick as many as apply', it was possible to code single respondents as having contacted both strong and weak ties for any given question.

Descriptive statistics are presented for each village. As displayed in Figure 8-17, the percentage of respondents in North Leigh who indicated that they could approach a *strong tie* for energy efficiency reasons ranged from 28% to 68.5%. The percentage of respondents who indicated that they could approach a *weak tie* ranged from 31.5% to 63.2%. These ranges are not too dissimilar, but in every category except two, there was at least a slight preference to access information through weak ties. The only two categories which respondents indicated being able to access resources more from strong ties were 'purchasing appliances advice' (Q7k) and 'knows about DIY?' (Q7l). However, binomial tests indicated that there was no significant difference in Q7k from the expected frequencies, based on a 50% benchmark. Further, binomial tests also revealed that there were no significant differences on five other variables (Q7d, Q7f, Q7g, Q7h, Q7j), meaning that even though there were slightly more weak ties reported, the difference was not a significant majority (see Appendix K).

friends, and those who indicated they were only acquaintances. Here, as friends is a separate category, it is assumed that if 'neighbour' is ticked, this might indicate some type of distinction from 'friends'.

Figure 8-17: Percentage of respondents in North Leigh who would approach strong or weak ties with each resource



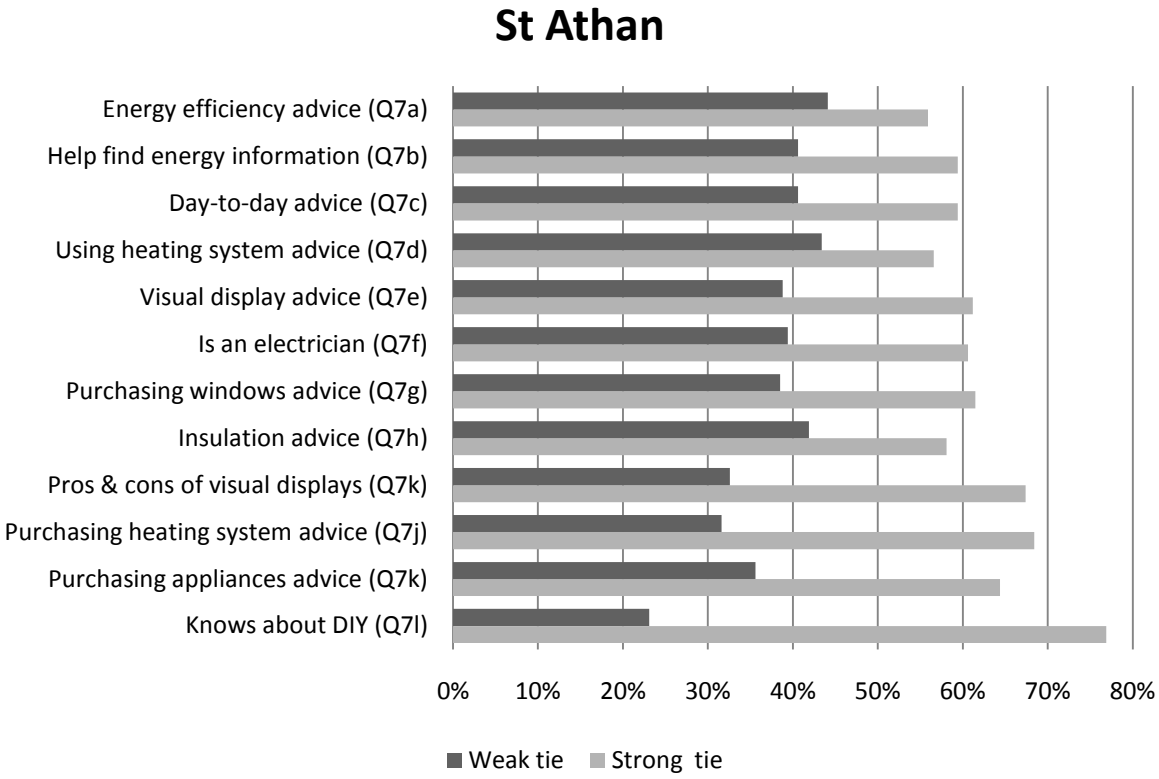
The qualitative findings in North Leigh were very similar to those as indicated in Hypothesis 2; focus group respondents indicated that in some instances, they would probably trust neighbours for advice, who would be considered a 'weak tie'.[181]

> R1(NL): "I'd probably trust a neighbour." (North Leigh, Resident focus group 1)
>
> R5(NL): "But it's come back to basics, like trusting your neighbour for advice." (North Leigh, Resident focus group 1)

[181] Strong ties were only mentioned in terms of past, i.e. mobilised 'energy social capital', and are discussed in the related Hypothesis 5b below.

Figure 8-18 depicts quite a different story in St Athan. For every single question in the Resource Generator, respondents were more likely to indicate that they would contact someone to whom they were strongly tied, though binomial tests indicated that six variables (Q7a, Q7c, Q7d, Q7e, Q7g, Q7h) were not significantly different from expected values based on a 50/50 split (see Appendix K). The percentage of respondents who indicated that they could approach a *strong tie* for energy efficiency reasons ranged from 55.9% to 76.9%. The percentage of respondents who indicated that they could approach a *weak tie* ranged from 23.1% to 44.1%.

Figure 8-18: Percentage of respondents in St Athan who would approach strong or weak ties with each resource



The qualitative findings from the 'Get Smart with St Athan' group indicate that there is some evidence that residents sought information from organisations (i.e. SSE, the local council and the local group).

> R4(SA): "I've had a couple of phone calls from people after we've leafleted just wanting some further advice on when we've leafleted on insulation grants and that sort of thing" ('Get Smart with St Athan' focus group)

> R9(SA): "We've had a couple of people coming through to the Local, asking the Local Authority from St Athan, not necessarily knowing about this Group though I think though, but just general, you know." ('Get Smart with St Athan' focus group)

> R5(SA): "We've also had some enquiries that have come to SSE because the smart metering elements of it." ('Get Smart with St Athan' focus group)

The one resident of the St Athan focus group indicated he would not seek information from anyone, as he knew the answers already, but if he had to, it would be from family.

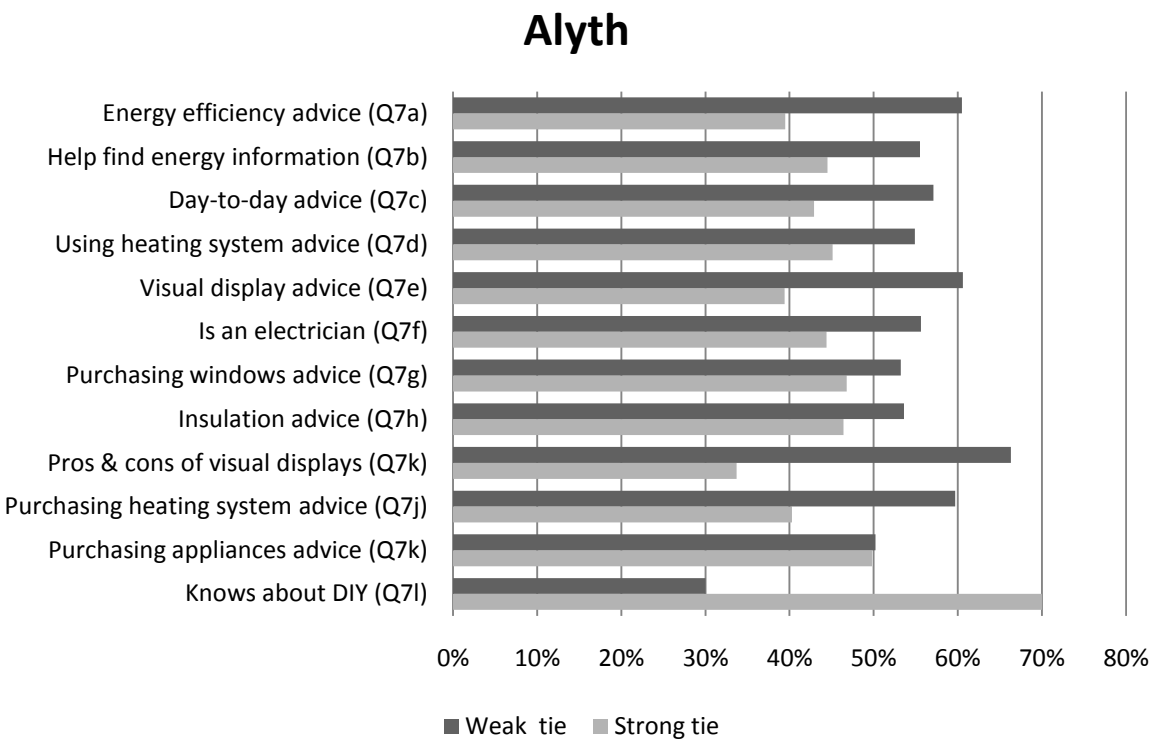
> Megan: "Who do you speak to about that? Your family or friends?
> R10(SA): Well, it's family isn't it. It's got to be."

The limited qualitative findings from the one respondent reflect the quantitative findings, but the lack of feedback from other participants means these qualitative findings should not be generalised to reflect more than the one respondent's personal opinions. Further, the 'Get Smart in St Athan' focus group findings did not reveal strong tie preference.

In Alyth, results were more similar to North Leigh than St Athan, as demonstrated in

Figure 8-19. Again, respondents were much more likely to indicate the accessibility of energy social capital through weak ties (percentages ranged from 30% to 66.3%) for almost every question except '...*knows a lot about DIY'.* Equal percentages indicated they knew strong and weak ties regarding someone who '*...would give you sound advice on purchasing energy efficiency appliances for your kitchen?*'. The percentage of respondents who indicated that they could approach a *strong tie* for energy efficiency reasons ranged from 33.7% to 70%. Binomial tests of each variable indicated that variables Q7b, Q7d, Q7g, Q7h and Q7k were not significantly different from expected frequencies, though the frequencies of weak ties were slightly higher in each case (see Appendix K).

Figure 8-19: Percentage of respondents in Alyth who would approach strong or weak ties with each resource



The qualitative findings in Alyth reflect similar indications as those in Hypothesis 2, except that the Resident focus group comments seem to contradict the quantitative findings, indicating that strong ties should be available and that it was not commonplace to ask neighbours for actual advice.

> R4(AL): "I think a lot of older people don't know what they are entitled to as well.
> R3(AL): No but the daughters should be able to tell them or the son, or whoever can." (Alyth, Resident focus group)

> R4(AL): "You might discuss things with other people and say I am doing this what are you doing, but I don't think you would go around to your neighbour and ask their advice." (Alyth, Resident focus group)

As mentioned in Hypothesis 2, however, the 'Alyth Energy Challenge' group indicated that they were approached by people for information, the assumption being that these group members are weakly tied to the people whom they are referring to.

> R5(AL) – "Certainly now you do see the local people and they, they stop [you] in the street. Based on the logo on the shirt. So ... there is penetration there now. You'd have to say probably better than it was before." ('Alyth Energy Challenge' focus group)

The quantitative findings in North Leigh and Alyth tend to support Granovetter's (1973) 'strength of weak ties' proposition which states that useful information is often found in social circles outside of an individual's own. The findings in St Athan were not expected, but may support the 'strength of strong ties' theory (Rogers 2003) which states that influence regarding adoption of innovations may be more important from

strong ties. Johnson Brown & Reingen (1987) indicate that perceived influence is associated with strong ties. These may be valid in St Athan, but it does not really explain why there are such differences between the communities. As Darley & Beniger (1981) indicate in their discussion of social networks and the diffusion of energy innovations, "the nature of kinship ties is likely to be a cultural determinant" (p.164). Perhaps there are differences in the cultural or social system which were not captured in the focus groups that would provide more information on influences on people's hypothetical choices on energy efficiency. Further research would be needed to understand the underlying differences.

In summary, the quantitative data indicates support for H3 in North Leigh and Alyth, but does not in St Athan, as summarised in Table 8-16, though the qualitative findings indicate quite varied findings in St Athan and Alyth, in particular.

Table 8-16: Hypothesis 3 confirmed?

Hypothesis	North Leigh	St Athan	Alyth
H3: Householders will report that accessible 'energy social capital' is available more through weak ties than through strong ties.	Yes	No	Yes

8.4.2 Research Question 2 & Hypothesis 4: accessible versus mobilised 'energy social capital'

The next research question was posed in order to understand the differences between accessible energy social capital and mobilised energy social capital:

> **Research Question 2**: Will respondents mobilise 'energy social capital' with everyone they know who can offer energy advice?

A corresponding single hypothesis was formulated to address this research question:

> **H4**: Householders will report more accessibility to 'energy social capital' than is actually mobilised.

The reason for examining this hypothesis is to understand the difference between hypothetical personal information resources for energy efficiency innovations and personal information resources which were actually contacted. The hypothetical information is from accessible energy social capital, which was here measured using the Energy Efficiency Resource Generator.

In order to compare accessible and mobilised 'energy social capital' (referred to here as Accessible ESC and Mobilised ESC, respectively), variables from both the Energy Efficiency Resource Generator and the filter questions for naming alters were compared for each innovation category for each of the four innovation categories, summarised in Table 8-17.

Table 8-17: Summary of the variables used to compare accessible & mobilised 'energy social capital' by innovation category

Innovation category	Accessible ESC *"Do you know anyone who ..."*	Mobilised ESC
Walls, windows, doors & floors (WWDF)	Q7g: "...would give you sound advice on purchasing energy efficient windows?" Q7h: "...would give you sound advice on insulating your house?"	Q9: "Thinking about insulation, draught-proofing or double/secondary glazing of windows, as above, did you discuss these with anyone to get information since [date programme started]?"
Visual displays of energy use (Visual)	Q7e:"...would give you sound advice on real-time energy displays (i.e. smart meters or current cost monitors)?" Q7i: "...can explain the pros and cons of having a smart meter installed?"	Q14: "Thinking about smart meters, or current cost monitors, or infrared thermal imaging, did you discuss these with anyone to get information since [date programme started]?"
Appliances, heating & lighting (AHL)	Q7d:"...would give you sound advice on how to use your heating system more efficiently?" Q7j: "...would give you sound advice on purchasing energy efficient heating systems?" Q7k:"...would give you sound advice on purchasing energy efficient appliances for your kitchen?"	Q19: "Thinking about energy efficient appliances, or heating, or lighting, did you discuss these with anyone to get information since [date programme started]?"
The way we act in the house (Behave)	Q7c:"would give you sound advice on changing day-to-day activities to help reduce energy use in your home?"	Q24:"Thinking about the actions in Question 23, did you discuss these with anyone to get information since [date programme started]?"

For the first three innovation categories (WWDF, Visual and AHL), two or three Energy Efficiency Resource Generator items were included. The variables in each innovation category were combined into one variable. If a respondent answered affirmatively for at least one question in each category, they were coded as having accessible energy social capital for that category.[182] And for the 'Behave' innovation category, there was only one question in the resource generator which applied, so a respondent would have to answer affirmatively to this one question to be considered to hold accessible 'energy social capital'. Mobilised energy social capital was assessed with the frequencies of answering the questions in the last column of Table 8-17, which was a filter question for the named alters. The answer categories were either yes, no or don't know.

[182] For example, if a respondent answered, 'yes' to Question 7g but not to Question 7h, they were still classified as being able to access energy social capital for the category of WWDF. If a respondent ticked the answer category of 'no' for every variable, then they were coded as not having accessible energy social capital for that category.

The frequency of responses for accessible 'energy social capital' and mobilised 'energy social capital' for North Leigh are summarised in Table 8-18.

Table 8-18: Accessible and mobilised 'energy social capital', North Leigh

		Accessible ESC			Mobilised ESC		
		N	%	Valid %[a]	N	%	Valid %[a]
WWDF	Yes	133	58.6	**61.3**	39	17.2	**18.4**
	No	84	37.0	**38.7**	173	76.2	**81.6**
	Missing / DK	10	4.4		15	6.6	
Visual	Yes	107	47.1	**49.5**	60	26.4	**27.5**
	No	109	48.0	**50.5**	158	69.6	**72.5**
	Missing / DK	11	4.8		9	4.0	
AHL	Yes	147	64.8	**66.8**	48	21.1	**22.1**
	No	73	32.2	**33.2**	169	74.4	**77.9**
	Missing / DK	7	3.1		10	4.4	
Behaviour	Yes	121	53.3	**55.5**	18	7.9	**8.3**
	No	97	42.7	**44.5**	200	88.1	**91.7**
	Missing / DK	9	4.0		9	4.0	

[a] Valid percent does not include missing data

The frequencies in Table 8-18 indicate that there are more indications of access to energy social capital in each innovation category than is mobilised within each category in North Leigh. Considering the valid percents, which exclude missing and 'don't know' answers, only 30% of the amount of accessible ESC is reported as mobilised for WWDF. For Visual, 55.6% of the amount of accessible ESC is reported as mobilised. For AHL, 33.1% of the percentage of accessible ESC is reported as mobilised. And for Behave, only 15% of the percentage of accessible ESC is reported as mobilised.

In order to understand these findings in more detail, Pearson's chi-square tests of significance were derived using crosstabulations of accessible ESC and mobilised ESC for each of the four innovation categories. As Table 8-19 indicates, all associations had significant results.

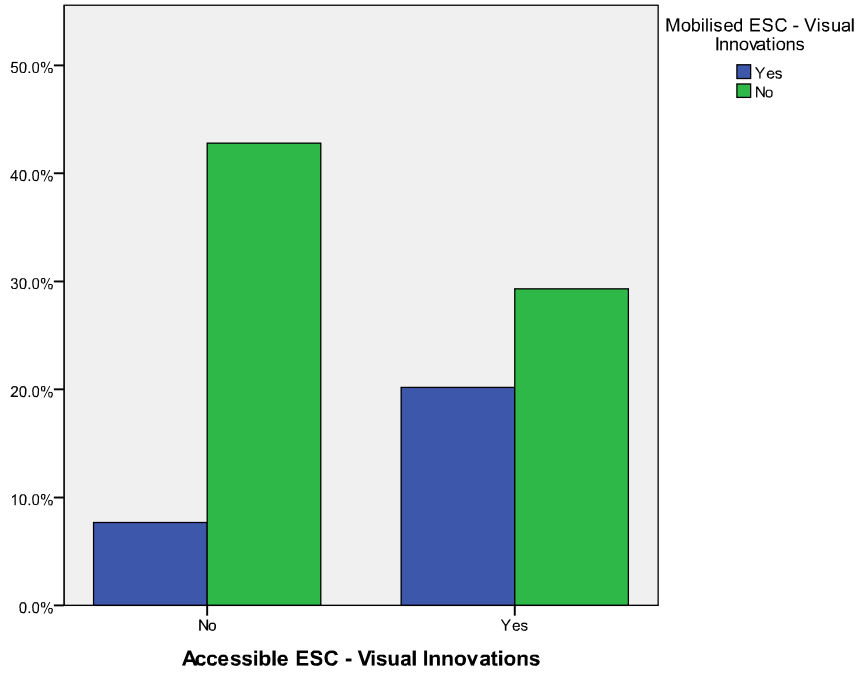
Table 8-19: North Leigh chi-square significant tests of accessible & mobilised 'energy social capital'

	χ^2	*df*	Sig
WWDF	6.799	1	0.009**
Visual	17.983	1	0.000***
AHL	6.988	1	0.008**
Behave	6.285	1	0.012*

*p<.05, **p<.01, ***p<.001

As an example, the most significant relationship, which occurred for visual displays, is graphically displayed in Figure 8-20.

Figure 8-20: Accessible & mobilised 'energy social capital' for Visual innovations, North Leigh



The blue bars indicate that if a respondent is able to access information on WWDF from interpersonal contacts, they were more likely to have indicated that they actually approached someone they knew for information on WWDF (frequency = 43) than if they indicated 'no' they were not able to access information on WWDF from people they knew (frequency = 16). Conversely, the green bars indicate that if respondents indicated 'no' they were not able to think of anyone who they could approach for information on WWDF, they were more likely to have indicated that they did *not* actually speak to anyone (frequency = 89) than those who indicated 'yes' they could think of someone with WWDF information (frequency = 60). The blue bar on the left is a slight anomaly: sixteen respondents indicated that they were *not* able to think of anyone to approach for WWDF information, but then also indicated that they *did* actually speak to someone to get WWDF information. Whether due to instrument design or an alternative understanding or interpretation of the questions by the respondent, the reasons for these 16 responses are unclear, as it is generally assumed that anyone who has mobilised social capital (i.e. actually spoke to someone) also had access to that social capital (i.e. would consider that person as a hypothetical source of information).

As the crosstabulations consisted of 2x2 tables, odds ratios could be determined, which were calculated in Excel, and confidence intervals of those odds ratios determined using software embedded into a website (see Pezzullo 2009).[183] The odds ratio indicates that those respondents who indicate that 'yes' they can access energy social capital are 3.99 times more likely (95% ci (2.07,7.67)) to have mobilised energy social capital than those who are not able to access energy social capital for Visual innovations.

Results for St Athan, as shown in Table 8-20 indicate that respondents were also more likely to report the ability access energy social capital than to report having mobilised energy social capital.

Table 8-20: Accessible & mobilised 'energy social capital', St Athan

		Accessible ESC			Mobilised ESC		
		N	%	Valid %	N	%	Valid %
WWDF	Yes	80	43.0	**47.9**	14	7.5	**8.4**
	No	87	46.9	**52.1**	152	81.7	**91.6**
	Missing / DK	19	0.5		20	10.8	
Visual	Yes	65	34.9	**38.7**	30	16.1	**18.6**
	No	103	55.4	**61.3**	131	70.4	**81.4**
	Missing / DK	18	9.7		25	13.4	
AHL	Yes	98	52.7	**58.3**	26	14.0	**15.4**
	No	70	37.6	**41.7**	143	76.9	**84.6**
	Missing / DK	18	9.7		17	9.1	
Behaviour	Yes	71	38.2	**42.0**	23	12.4	**12.9**
	No	98	52.7	**58.0**	155	83.3	**87.1**
	Missing / DK	17	9.1		8	4.3	

Using the valid percents (i.e. not considering missing or 'don't know'), 17.5% of the amount of accessible ESC is reported as mobilised for WWDF. For Visual, 48.1% of the amount of accessible ESC is reported as mobilised. For AHL, 26.4% of the percentage of accessible ESC is reported as mobilised. And for Behave, only 30.7% of the percentage of accessible ESC is reported as mobilised.

[183] The odds ratio is a type of effect size appropriate for 2x2 contingency tables. It is the "ratio of the *odds* of an event occurring in one group compared to another" and is determined by dividing the odds of one event occurring by the odds of the compared event occurring (Field 2005, p.32).

Chi-square tests, as in
Table 8-21, indicate that only two innovation categories – Visual innovations and AHL innovations - had significant associations in the crosstabulations.

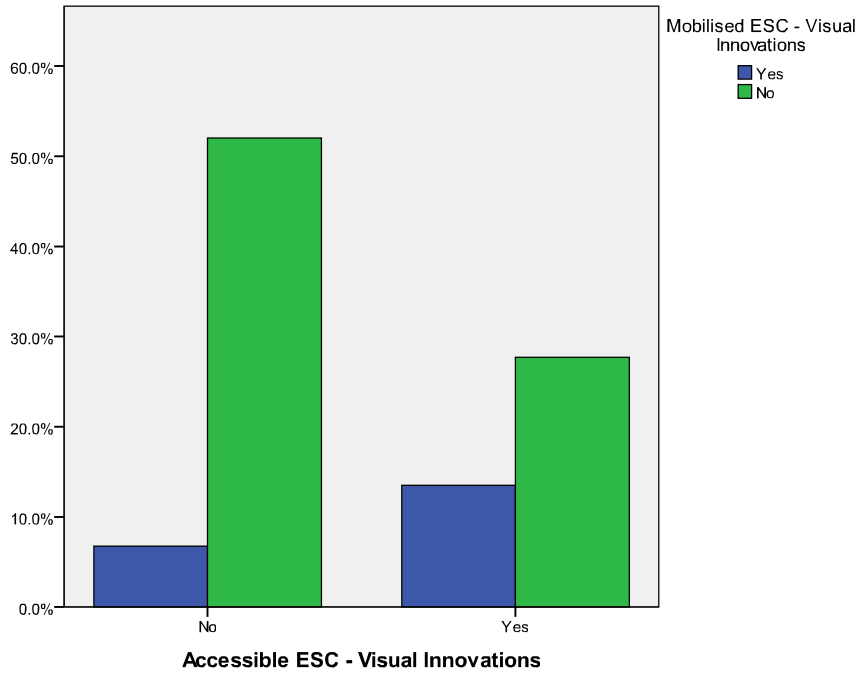
Table 8-21: St Athan chi-square tests of significance of accessible & mobilised 'energy social capital'

	χ^2	*df*	Sig
WWDF	1.568	1	0.211
Visual	10.059	1	0.002**
AHL	8.649	1	0.003**
Behave	2.926	1	0.087

***p*<.01

Figure 8-21 demonstrates graphically the comparison of accessible and mobilised energy social capital for the innovation category Visual. In this case, the odds ratio indicates that those who said 'yes' they were able to access energy social capital were 3.76 time more likely (95% ci (1.63,8.65)) to have mobilised 'energy social capital' than if they indicated 'no' they could not access energy social capital.

Figure 8-21: Accessible & mobilised 'energy social capital' for Visual innovations, St Athan



In Alyth, there was also more accessible energy social capital reported for each innovation category than mobilised energy social capital, as summarised in Table 8-22.

Table 8-22: Accessible & mobilised 'energy social capital', Alyth

		Accessible ESC			Mobilised ESC		
		N	%	Valid %	N	%	Valid %
WWDF	Yes	268	55.9	**59.8**	67	14.0	**15.4**
	No	180	37.6	**40.2**	367	76.6	**84.6**
	Missing / DK	31	6.5		45	9.4	
Visual	Yes	238	49.7	**53.0**	82	17.1	**18.8**
	No	211	44.1	**47.0**	355	74.1	**81.2**
	Missing / DK	30	6.3		42	8.8	
AHL	Yes	337	70.4	**74.7**	95	19.8	**21.1**
	No	114	23.8	**25.3**	355	74.1	**78.9**
	Missing / DK	28	5.8		29	6.1	
Behaviour	Yes	273	57.0	**61.3**	54	11.3	**12.1**
	No	172	35.9	**38.7**	394	82.3	**87.9**
	Missing / DK	34	7.1		31	6.5	

For WWDF, 25.8% of the amount of accessible ESC is reported as mobilised, considering valid percents. For Visual, 35.5% of the amount of accessible ESC is reported as mobilised. For AHL, 28.2% of the percentage of accessible ESC is reported as mobilised. And for Behave, only 19.7% of the percentage of accessible ESC is reported as mobilised.

Chi-square tests, as in Table 8-23, indicate that two innovation categories had significant associations in the crosstabulations.

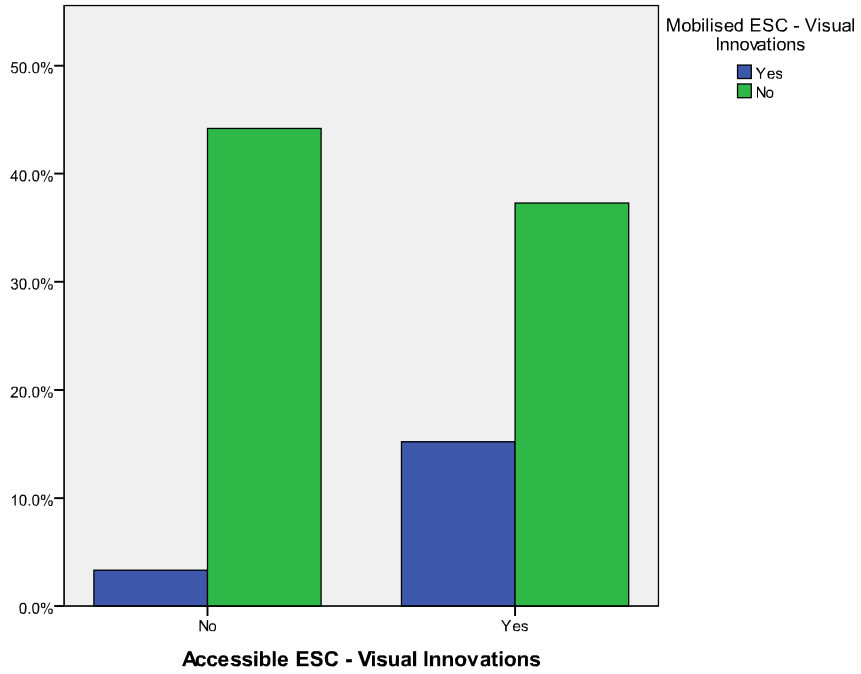
Table 8-23: Alyth chi-square significance tests of accessible & mobilised 'energy social capital'

	χ^2	*df*	Sig
WWDF	24.705	1	0.000***
Visual	33.539	1	0.000***
AHL	13.023	1	0.000***
Behave	17.387	1	0.000***

****p*≤.001

Figure 8-22 demonstrates graphically the comparison of accessible and mobilised energy social capital for the innovation category Visual. Here, the odds ratio tells us that those who 'yes' are able to access social capital are 5.41 times more likely (95% ci (2.95, 9.95)) to have mobilised 'energy social capital' than those who are not able to access energy social capital.

Figure 8-22: Accessible & mobilised 'energy social capital' for Visual innovations, Alyth



In summary, for the innovation categories WWDF, AHL and Behave, between 15-33% of the amount of accessible 'energy social capital' was actually reported as mobilised for each innovation category in all three communities. The notable exception was Visual displays. In North Leigh and St Athan, 55.6% and 48.1% (respectively) of the amount of reported accessible 'energy social capital' was reported as mobilised. As the respondent was asked to think of mobilised 'energy social capital' within the timeframe of the intervention, it is not entirely surprising that the reports in this category should be a bit higher. The visual display innovations were generally introduced after the interventions began, whereas loft insulation, cavity wall insulation, double-glazing, and behavioural changes are all innovations which respondents would have had more opportunities to speak and know about before the intervention. However, in Alyth, only 35.5% of the amount of accessible 'energy social capital' was reported as mobilised. The qualitative data offers a possibly explanation as to why this percentage is lower than in North Leigh and St Athan. The street-by-street campaign was much more pro-active in contacting residents in their homes, going door-to-door to offer advice. The following quote summarises the fact that the topic of the focus group did not touch on

smart meters, which is perhaps also indicative of the fact that the topic of the ACAT initiatives were not necessarily on the smart meters, i.e. a type of visual display:

> R14 (AL) – "I mean a lot of this discussion has been around what's happened since the street-by-street programme started, but there was a year prior to that when there was a smart metering trial going on which is technically still going on."

The following quote by the SSE representative also emphasises the fact that the focus group of the 'Alyth Energy Challenge' was not fully aimed at the SSE-supported (i.e. the EDRP funded) trials, which included the smart meters:

> R14 (AL) – "And as I say, I mean, all the work that has been done around the street-by-street programme which is going to reduce the communities energy and get people warmer and save people money and get 'em out of fuel poverty, it's all been great, but it's all come about as a result of the street-by-street programme rather than as a result of the EDRP."

From this information, and the discussion surrounding this topic, the quantitative results are at least partially explained.

An obvious conclusion is that the mere possibility of having someone to ask about energy efficiency appears to be related to the chance that a person will be able to actually seek that information. But this may have implications which are much further reaching, particularly considering the comments from North Leigh and Alyth which indicated that awareness grew over time:

> R18(NL): "Yeah, I mean whenever it started I can remember seeing something in the Nor'Lye News, which is our North Leigh bible, and I think I probably, I glazed over the first time. Then it was repeated. So then you begin to think well there might be something in it." (North Leigh, Resident Focus group 3)

> R18 (NL): "When I think that sort of communication is good. I mean had it not been for the drip feed that you get, you know you ignore perhaps every other month. But occasionally something catches your eye. A simple thing like a banner in the village about this event that's been going on today. I didn't come to it but it brings, it keeps the momentum going somehow. It just makes you think about it." (North Leigh, Resident Focus group 3)
> R18 (NL): Continued: "It takes a while. It's a because it's drip-feeding. And there's nothing like publicising the fact that somebody has got something out of it. (North Leigh, Resident Focus group 3)

> R1(AL): "I mean it's sort of a private theory, but there's an approach that trying to change people's attitudes over night in small communities in Scotland it just doesn't necessarily work, you can often get a reaction strongly back the other way. But a dripping tap will fill the sink in the end." (Alyth, Resident Focus group)

It appears to be that as the programmes were drawing to an end, they may have had the 'majority' or 'late adopters' only starting to attempt to mobilised 'energy social capital'.

> R5(AL) – "Certainly now you, do see the local people and they, they stop [you] in the street. Based on the logo on the shirt. So ... there is penetration there now. You'd have to say probably better than it was before." ('Alyth Energy Challenge' focus group)

> R10 (AL): "Nevertheless, it's a body there to administer and continue, this project has a finite time, it has information, but it doesn't have a physical place, as yet, a long-term physical place to

> store the information that we've got, that could be picked up in the future, and continued for phase 2,3,4." ('Alyth Energy Challenge' focus group)

The insinuation in the last comment is that without on-going local availability of energy efficiency information, the opportunities for increasing awareness and encouraging the diffusion of innovations with even more people might be lost. Having established the sources of information (the accessible 'energy social capital') for respondents, those 'majority' and 'late adopter' respondents may not be able to mobilise it if the funding ends and no one is available to be contacted. It seems the 'brand awareness' and message increased over time – a timescale which will outlast the programme.

A further comparison (Table 8-24) was made by comparing averages of accessible 'energy social capital' (as explained in Appendix J) and the self-reported mobilisation of 'energy social capital' with at least one person (as summarised in section 8.3.8). The accessible 'energy social capital' column includes the overall average of the item averages for each of the 12 questions in the Energy Efficiency Resource Generator for North Leigh and St Athan and 11 questions in Alyth.[184]

Table 8-24: Comparison between accessible & mobilised 'energy social capital'

Community	Accessible 'energy social capital': Total average (%) of respondents who indicate knowing anyone with a resource	Mobilised 'energy social capital': Percentage of respondents who indicated seeking information from at least one person
North Leigh	55%	54%
St Athan	45%	41%
Alyth	57%	47%

Table 8-24 is meant to test whether the Energy Efficiency Resource Generator could act as a proxy for indications of mobilised 'energy social capital'. It appears that this may be the case, though more consistently in North Leigh; in St Athan and Alyth, more respondents indicated accessibility than mobilisation. Thus, the implication is that the Energy Efficiency Resource Generator may roughly act as a proxy for indications of being able to mobilise 'energy social capital' with at least one person, but not reliably between communities.

In summary, the hypothesis that more accessible 'energy social capital' was available than mobilised 'energy social capital' was confirmed in all three communities (see Table 8-25), in accordance with the literature (Lin 2001b; van der Gaag & Webber 2008).

[184] "Mokken scaling" (see Appendix J) indicated a high degree of homogeneity and high reliability across all items (North Leigh: $H = 0.52$, $\rho = 0.90$; St Athan: $H = 0.54$, $\rho = 0.90$). In Alyth, the 'Mokken scaling' only indicated 11 items created a high degree of homogeneity and reliability ($H = 0.60$, $\rho = 0.92$), and so only those 11 are included here.

Table 8-25: Hypothesis 4 confirmed?

Hypothesis	North Leigh	St Athan	Alyth
H4: Householders will report more accessibility to 'energy social capital' than is actually mobilised.	Yes	Yes	Yes

8.4.3 Research Question 3: mobilised 'energy social capital' and the diffusion of energy-reducing innovations

The third research question asks:

> **Research Question 3**: What are the features of mobilised 'energy social capital' and how will they be associated with the diffusion of energy-reducing innovations?

8.4.3.1 Hypothesis 5

The overarching hypothesis is that:

> **H5**: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital'

A set of crosstabulations were conducted comparing adoption rates from each innovation category with associated indicators for mobilised energy social capital. 'Adoption' was assessed by determining which respondents indicated that they adopted at least one innovation in each category after the point of intervention, i.e. when the energy efficiency programme began in each village or town, which was either September 2007 (for North Leigh and Alyth) or March 2008 (for St Athan). Mobilisation of 'energy social capital' was determined with a single question for each of the four innovation categories, as in Table 8-17 above. Table 8-26 demonstrates the results of the Pearson's chi-square test of significance in North Leigh based on crosstabulations.

Table 8-26: Chi-square results of mobilised 'energy social capital' and adoption of energy-reducing innovations, North Leigh

North Leigh			
	χ^2	*df*	Sig
WWDF	5.572	1	0.018*
Visual	10.924	1	0.001**
AHL	3.997	1	0.046*
Behaviour	0.780	1	0.377

*p<.05, **p<.01

There was a significant relationship between adopting at least one of the WWDF innovations and seeking information about it (χ^2 (1)=5.572, p<.05) in North Leigh. The odds ratio indicated that those who had mobilised 'energy social capital' (i.e. indicated speaking to someone for information) were 2.44 times more likely (95%ci (1.16,5.12)) to adopt than someone who had not mobilised 'energy social capital'. There was also a

significant relationship between adopting at least one Visual innovation and seeking information about it (χ^2 (1)=10.924, p<.01). The odds ratio in this case indicated that those who mobilised ESC were 2.88 times more likely (95% ci (1.53,5.45)) to adopt than someone who had not mobilised ESC. Further, there was a significant relationship between adopting at least one AHL innovation and speaking to people about it (χ^2 (1)= 3.997, p<.05). The odds ratio indicated that those who mobilised ESC were 2.41 times more likely (95% ci (1.02,5.68)) to adopt than someone who had not mobilised ESC. There was no significant relationship between changing at least one behaviour and speaking to anyone about it, though (χ^2 (1)=.780, p=.377).

Though the odds ratios indicate support for the hypotheses in three innovation categories, the significance of chi-square tests simply indicates the difference between expected and actual frequencies. The findings were thus examined further to more fully understand the data, and summarised for North Leigh in Table 8-27. Though the odds ratios indicated that those who mobilised 'energy social capital' were on average 2.5 times as likely to have adopted in three innovation categories, this simply compares the frequencies in Column **B** (here represented as percentage of all answers per innovation category) with Column **A** is summarised in Table 8-27. The crosstabulations which produced the chi-square test revealed that respondents were almost twice as likely (if not much more likely) to have *not* mobilised 'energy social capital' (Column **C**), as opposed to mobilised 'energy social capital' (Column **A**), and still adopted. This seems to indicate that mobilising 'energy social capital' is not the only influence in the innovation-decision and adoption process.

Table 8-27: Adoption & mobilised 'energy social capital' cross-tabulation results by discussion within an innovation category, North Leigh[185]

North Leigh	**Column A** Yes & Adopted		**Column B** Yes & Did not adopt		**Column C** **No & Adopted**		**Column D** No & Did not adopt	
	n	% of whole	*n*	% of whole	***n***	**% of whole**	*n*	% of whole
Discuss WWDF?*	21	13.4%	16	10.2%	42	26.8%	78	49.7%
Discuss Visual?*	40	18.9%	18	8.5%	67	31.6%	87	41.0%
Discuss AHL?*	37	19.4%	7	3.7%	101	52.9%	46	24.1%
Discuss Behave?	14	6.5%	4	1.9%	134	62.0%	64	29.6%

*=Significant chi-square

However, for WWDF and Visual innovations there were still more people who did *not* mobilise 'energy social capital' and *did not* adopt (Column **D**) than those that did *not* mobilise 'energy social capital' and *did* adopt (Column **C**). This means that if people did *not* speak to others, they were actually more likely *not* to adopt, which lends further

[185] Each row in the table totals 100%

support to accepting the research hypothesis. There were two comments from the qualitative findings on WWDF innovations, the first of which indicates that people may prefer to speak to people for information, but is rather hypothetical, and the second of which indicates that people do not always need to speak to people.

> R8(NL) – Discussing current cost monitors: "Yeah, I've said this before, I personally feel the most benefit was when it was explained to people." ('Challenge North Leigh' focus group)

> R17(NL): "Were you encouraged to do the thermal imaging, to get that done?
> R19(NL): No, I just got fed up with painting." (North Leigh, Residents focus group 3)

There were very different findings for the AHL and Behave innovations in Table 8-27; the findings were the opposite of WWDF and Visual, in that there were far more people who had *not* mobilised 'energy social capital' and adopted (Column **C**) than those who did not adopt (Column **D**). This seems to indicate that for these two innovation categories (AHL and Behave), mobilising 'energy social capital' did not influence adoption during the time period specified. This could indicate that something else inspired adoption. For example, it may be that mass media advertising or other non-interpersonal sources of information are more influential for appliances, heating and lighting (AHL) and behaviour-related innovations. This could indicate that the qualitative findings suggest that the lighting innovations, in particular, are so widely known that respondents do not need to speak to anyone in the time frame of the intervention, but that the adoption of low-energy lighting might lead to other adoption considerations:

> R7(NL) – "I talked to a lady who announced herself as [NAME]. She said, 'I've done the first bit with the light bulbs.' I mentioned earlier, people start with light bulbs, 'what do I do next'?" ('Challenge North Leigh' focus group)

> R8(NL) – "And often, once the people are engaged and talking about that it moves on to other things. Light bulbs seems to the easiest thing because that's what everyone's aware of. And everyone's heard of what we need to do. It's not until you speak to them you think well actually they don't actually know really what to do. ... But people are aware that something needs to be done, but not quite sure how to do it. And quite often some of the conversations I've had, as regards to basic energy efficiency in the house, a lot of people, 'Oh I didn't realise that. Oh I'm surprised to hear that.' And it's when you talk to people like that, on a one-to-one, I find it's quite beneficial." ('Challenge North Leigh' focus group)

The second comment encompasses innovations in both AHL and Behave, so perhaps it is this general awareness related to these innovations, or mobilisation which has occurred in the past, which eliminates the need for mobilising 'energy social capital', but which may lead to mobilisation of 'energy social capital' for other innovations which still cause uncertainty for the adopter.

In St Athan, as summarised in Table 8-28, the only significant association was in the innovation category 'visual displays' (χ^2 (1)=10.720, p<.01). Those who indicated that they mobilised 'energy social capital' regarding a visual display were 3.9 times more

likely to adopt (95% ci (1.70,9.05)) than those who did not mobilise 'energy social capital'.[186]

Table 8-28: Chi-square results of mobilised 'energy social capital' and adoption of energy-reducing innovations in St Athan

St Athan			
	χ^2	*df*	Sig
WWDF			0.206[b]
Visual	10.720	1	0.001**
AHL	0.602	1	0.438
Behaviour	0.053	1	0.817

***p*<.001

[b] Fisher's exact test

Looking at the crosstabulation data (Table 8-29) revealed again that more people had *not* mobilised 'energy social capital' and adopted (Column **C**) than those who did mobilise 'energy social capital' and adopted (Column **A**).

Table 8-29: Adoption & mobilised 'energy social capital' cross-tabulation results by discussion within an innovation category, St Athan

St Athan	**Column A** Yes & Adopted		**Column B** Yes & Did not adopt		**Column C** **No & Adopted**		**Column D** No & Did not adopt	
	n	% of whole	*n*	% of whole	***n***	**% of whole**	*n*	% of whole
Discuss WWDF?	6	5.2%	5	4.3%	36	31.3%	68	59.1%
Discuss Visual?*	17	12.0%	12	8.5%	30	21.1%	83	58.5%
Discuss AHL?	14	9.7%	9	6.3%	63	43.8%	58	40.3%
Discuss Behave?	11	6.3%	11	6.3%	72	41.4%	80	46.0%

*=Significant chi-square

As in North Leigh, the majority of respondents *did not* mobilise energy social capital and *did not* adopt (Column **D**) in the categories of WWDF (59%) and Visual (63%). In St Athan, this was also the same for the Behave innovations, as well, though to a lesser extent: the majority did not mobilise 'energy social capital' and did not adopt, but this only accounted for 46% of respondents. Again, these findings of not mobilising 'energy social capital' and not adopting may provide some support for accepting the research hypothesis. Like North Leigh, as well, the AHL category was different, in that most respondents (44%) *did not* mobilise 'energy social capital' but *did* adopt (Column **C**). The qualitative findings from the St Athan focus groups did not yield anything specific about these innovations, but it may be similar to North Leigh in that light bulbs (or heating or appliance purchasing) may be something which does not require

[186] Table 8-28 demonstrates these results, most of which used chi-square to test significance, though as these were 2x2 tables, Fisher's exact test of significance is presented where the data violate the assumptions of a chi-square test (i.e. if the expected frequency is less than 5 in any cell). Fisher's exact test is similar to chi-square test, but only able to handle 2x2 contingency tables (Weinbach & Grinnell 1997).

mobilisation of 'energy social capital', or it had occurred previous to the timeframe indicated, but which may prompt a respondent to seek advice on other innovations in the timeframe of the intervention. There were a few comments in the qualitative findings about personal recommendations being advantageous, though they were not specific to any innovation.

The results of Pearson's chi-square tests of significance for Alyth are summarised in Table 8-30.

Table 8-30: Chi-square results of mobilised 'energy social capital' and adoption of energy reducing innovations, Alyth

Alyth			
	χ^2	df	Sig
WWDF	25.245	1	0.000***
Visual	10.095	1	0.001**
AHL	3.834	1	0.050
Behaviour	5.725	1	0.017*

*p<.05, **p<.01, ***p<.001

There was a significant relationship between adopting at least one of the WWDF innovations and seeking information about it (χ^2 (1)=55.245, p<.001). The odds ratio indicated that those who had mobilised 'energy social capital' (i.e. indicated speaking to someone for information) were 4.66 times more likely (95%ci (2.49,8.70)) to adopt than someone who had not mobilised 'energy social capital'. There was also a significant relationship between adopting at least one Visual innovation and seeking information about it (χ^2 (1)=10.095, p<.001). The odds ratio in this case indicated that those who mobilised ESC were 2.31 times more likely (95% ci (1.37,3.88)) to adopt than someone who had not mobilised ESC. There was no significant relationship between mobilising ESC and adopting at least one AHL innovation (χ^2 (1)= 3.834, p=.05). But there was a significant relationship between mobilising ESC and changing at least one behaviour (χ^2 (1)=5.725, p<.05). The odds ratio indicated that those who mobilised ESC were 2.05 times more likely (95% ci (1.14,3.69)) to adopt a behaviour change than someone who had not mobilised ESC.

Upon further examination, the data in the crosstabulations (
Table 8-31) revealed that respondents were at least twice as likely to have *not* mobilised 'energy social capital' and still adopted (Column **C**), than mobilised 'energy social capital' and adopted (Column **A**), across all categories.

Table 8-31: Adoption & mobilised 'energy social capital' cross-tabulation results by discussion within an innovation category, Alyth

Alyth	**Column A** Yes & Adopted		**Column B** Yes & Did not adopt		**Column C** **No & Adopted**		**Column D** No & Did not adopt	
	n	% of whole	*n*	% of whole	***n***	**% of whole**	*n*	% of whole
Discuss WWDF?*	36	12.5%	18	6.3%	70	24.4%	163	56.8%
Discuss Visual?*	32	8.2%	44	11.3%	75	19.3%	238	61.2%
Discuss AHL?	58	16.3%	16	4.5%	187	52.7%	94	26.5%
Discuss Behave? *	34	7.7%	19	4.3%	180	41.0%	206	46.9%

*=Significant chi-square

For WWDF, Visual and Behave innovations, there were still more people who did *not* mobilise 'energy social capital' and did *not* adopt (Column **D**) than those that did not mobilise 'energy social capital' and did adopt (Column **C**). This accounted for the highest percentage of respondents for each innovation category except AHL, which again yields further evidence for accepting the research hypothesis. Statements from the focus groups yielded some information that indicated that people mobilised 'energy social capital' before adopting, but while considering, Visual innovations.

> R9(AL) – "People still speak about smart meters.
> R14(AL) – Yeah
> R9(AL) – Yeah, and people that didn't get them, cause they weren't suitable or whatever, are still miffed about it. ' I never got a smart meter!'
> R14(AL) – I've still got people on the phone [at SSE] asking for smart meters." ('Alyth Energy Challenge' focus group)

> R9(AL) – "Yeah, that's the difference with the current cost monitors, because you have to go in and set them for people.
> R11(AL) – Well, there, a lot of them are straightforward as well
> R9(AL) – Yeah, but we taught people how to use them as well, yeah. And often people get them because they've asked for them, rather than, you know, just being given them." ('Alyth Energy Challenge' focus group)

There were also examples from the Residents focus group of Alyth residents specifically asking for current cost monitors, which was associated with speaking to a neighbour in one case (third comment below).

> R4(AL): Current cost monitor: "They came from the Hydro board didn't they?
> R2(AL): That's right I had to ask for mine." (Alyth Residents focus group)

> R1(AL): "And that is still working its way through people because someone came and did our energy audit just last Monday of last week and we are waiting for our monitor meter to arrive and all that." (Alyth Residents focus group)

> R4(AL): Talking about energy efficiency to people: "But I must admit I hear it mentioned quite a lot. I mean my neighbours talk about it and I have got friends when I got that little monitor thing said why we haven't got one and got onto the Hydro board and said where is ours. So I think people do." (Alyth Residents focus group)

Like St Athan, only the AHL category yielded the most (52.7%) respondents indicating they did *not* mobilise 'energy social capital' but did adopt (Column **C** in

Table 8-31). There was no findings from the focus groups regarding this category, but it may have been similar to North Leigh in that people know about AHL innovations already, and therefore do not need to mobilise 'energy social capital' in the innovation-decision process.

In summary, the chi-square tests reveal significant results with Visual displays and WWDF innovations, but not with AHL or Behave innovations. Quantitative and qualitative findings indicate that Visual displays are particularly associated with mobilisation of 'energy social capital' in all three communities. Given the novelty of the innovation, the fact that media-based information on these innovations is only beginning to spread, and the fact that people generally want information on innovations which they do not fully understand, such as smart meters (Hargreaves 2010), this is not surprising. The results are summarised in Table 8-32.

Table 8-32: Hypothesis 5 confirmed?

Hypothesis	North Leigh	St Athan	Alyth
H5: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital'.	Yes and No, depending on innovation	Yes and No, depending on innovation	Yes and No, depending on innovation

An unexpected finding from these results appears to provide evidence that all energy efficiency innovations cannot be considered to diffuse through a social system in exactly the same way. This confirms a tenet of the social network-based diffusion model for energy efficiency innovations which Darley & Beniger (1981) put forward:

> "The contact system involved in a diffusion process, or the particular system involved at any one time, depends on the nature of the innovation being diffused. One is not likely to hear about insulating a water heater, for example, from the same source as one hears about thermal curtains ... Many types of contact systems operate simultaneously in a society, so that the movement of information about one innovation may be entirely different from that about another" (p.164).

Different types of information thus may not always reside in the same social (or non-social) resources. Further, the location of the information resource may not always serve the same function. For instance, there are suggestions that some information-seeking is not only to 'solve a problem', but to elicit social support (Bartiaux 2008) or understand normative beliefs (Midden & Ritsema 1983). A study in the Netherlands in 1981 surveyed householders and asked questions regarding normative beliefs about energy conservation and the motivation to comply with various people, such as family, friends and neighbours. In their findings, the authors recommended that:

> "Change programs which aim to use normative processes should ... distinguish between specific behaviors and not regard energy conserving behavior as one homogeneous set of behaviors" (Midden & Ritsema 1983, p.53).

Though the focus on normative influence was not the focus of the research here, a message emerges that it may be important to consider the information available through social networks associated with specific types of energy efficiency technologies and behaviours.

The discrepancy between innovations may also be due to the frequency of personal actions involved. People tend to want to justify past behaviour; if new information contradicts the actions, cognitive dissonance[187] may lead people to ignore it, as it does not align with previous actions, attitudes or beliefs (Shipworth 2000). Therefore, it could be that information, such as those in the Behave category or those which require semi-frequent maintenance (such as replacing light bulbs), may be more easily forgotten or ignored. However, it is noted that the innovation categories of AHL and Behave were located at the end of the questionnaire. It is speculated that the question order may have had an effect (de Vaus 2002a), but further research would be needed to test this.

A further consideration was briefly given to the type of person who mobilised 'energy social capital' and adopted. As noted in section 8.4.1.1 above, there appeared to be slight differences in information-seeking indications of certain age groups and education levels. Fisher's exact tests were performed regarding mobilisation of 'energy social capital' and adoption by each of the age categories, education levels, as well as ownership of dwelling, as the latter was hypothesised to effect differences in actions. Table 8-33 summarises the findings.[188]

[187] Cognitive dissonance theory states "that when a person has two beliefs or items of knowledge that are not consistent with each other, then there is a tendency to reduce this dissonant state" (Kantola et al. 1984).
[188] See Appendix K for raw data.

Table 8-33: Fisher's exact tests of significance comparing mobilised 'energy social capital' and reported adoption of innovations by age, education and ownership of home

		Age (in years)			Education			Own or rent	
		16-44	45-64	65+	Degree	Other qual.	No quals	Own	Rent
North Leigh	WWDF	1.536	2.321	3.325	4.271	.422	.103	7.336*	.889
	Visual	1.393	4.964*	4.433*	5.850*	3.302	1.710	6.128*	6.296*
	AHL	.017	1.854	4.192	1.810	1.398	.716	4.041	.197
	Behave	1.336	.746	.037	1.062	.119	.407	.317	-[a]
St Athan	WWDF	1.867	.247	.882	-[a]	1.105	.900	6.402*	2.654
	Visual	1.082	14.037***	.334	2.471	5.663*	2.108	10.247**	.000
	AHL	.305	2.382	.600	.051	.206	.408	.404	-[a]
	Behave	.580	.008	.000	1.810	.178	.264	.068	.221
Alyth	WWDF	10.866**	6.586*	6.812*	8.177*	12.229**	3.999	23.883***	2.003
	Visual	5.122*	12.384**	.002	9.620**	2.246	1.160	7.953**	.911
	AHL	2.149	.949	1.652	11.797**	.095	.350	8.247**	.435
	Behave	6.436*	.955	.254	.456	4.278*	.439	2.722	1.113

* $p<.05$, ** $p<.01$, *** $p<.001$
[a] Insufficient data

Table 8-33 indicates the innovations which differed from expected frequencies for each category of age, education and whether the respondents owned or rented their homes. Those who indicated that they owned their home had significant results in the innovation categories of WWDF and Visual for each of the three communities (and AHL in Alyth). Alyth had many significant results: each category for age on WWDF and Visual (except 65+ for visual) and for all innovations except Behave on the highest education category (i.e. degree level or higher) were significant. It must be noted that these results in Alyth could be due to the greater amount of data, as Fisher's exact test of significance is sensitive to frequencies. This means there may have been insufficient data in North Leigh and St Athan to produce similar results. Regardless, the significant differences largely seem to vary by innovation, and rather randomly within age and education categories. This implies that there may be factors of age and education which are relevant for adoption, though mainly with Visual and WWDF innovations (and AHL and Behave in Alyth). Further research may more clearly indicate the differences according to these and other sociodemographic variables.

8.4.3.2 Hypothesis 5a: Community members

In parallel to Hypothesis 2 above, a similar hypothesis is formulated regarding mobilised 'energy social capital' and the association of the geographic location of alters with diffusion and adoption of energy-reducing innovations:

> **H5a**: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with those in the same geographic location.

Though this hypothesis is contrary to much community literature (Darley 1978; Wellman 1979), this hypothesis is meant to test the growing focus on community-level interventions for energy efficiency (Kellet 2007) and the structure of the SSE interventions. The contacts who were living in the same community as the respondent were determined by summing the number of people who affirmatively answered the question, *Do they live in [name of community]?* which followed the naming of each alter. Thus, there were up to three people, referred to here as Alter 1, Alter 2 and Alter 3, which a respondent could indicate living in the same community for each innovation category. In order to understand the association between adoption and whether or not the person approached was in the community, chi-square tests were performed for each alter in each innovation category for each village, and chi-square tests were reported when expected frequencies were not less than 5 in any cell. Thus, two dichotomous variables were compared: adoption / non-adoption and in community / not in community, as summarised in Table 8-34 (frequencies are provided in Appendix K).

Table 8-34: Pearson's chi-square significance tests for adoption of each innovation category & presence of alters in community (*df*=1)

		Live in same community?		
		North Leigh	St Athan	Alyth
WWDF	Alter 1	1.800	0.076	0.236
	Alter 2	0.422	4.286	2.804
	Alter 3	1.311	0.533	0.533
Visual	Alter 1	0.001	0.800	0.094
	Alter 2	1.014	3.348	0.589
	Alter 3	1.200	0.196	0.910
AHL	Alter 1	0.042	1.351	0.181
	Alter 2	0.112	0.010	1.334
	Alter 3	0.148	0.000	0.533
Behave	Alter 1	1.340	0.000	0.140
	Alter 2	-[a]	2.213	0.142
	Alter 3	-[a]	2.722	1.110

[a] Insufficient numbers

The results in Table 8-34 indicate that there were no significant associations from these tests in any village, regardless of innovation category. The reason for this is both due to little variation in the data, and also the low responses received for this question. There were also often times that respondents indicated that they spoke to someone, but did not name them or answer the questions about that person, thus leaving the *Do they live in [North Leigh/St Athan/Alyth]* question blank. This may have been for privacy issues, as it was indicated in the pre-test that some people did not want to name alters (i.e. people) from whom they received information. There were also many cases where

people did not know if the person lived in the community or not, which is not accounted for in the significance tests in Table 8-34.

From the focus groups, there are statements to suggest that respondents in all three communities spoke to people within the community, such as neighbours:

> R11 (NL):[189] "Yeah, the Green Fair, so we actually came up to have a look at the Green Fair to see what it was all about. And that actually drew us in from outside. If it hadn't been there I don't suppose that we would have done anything about it, because we were just right at the end of the village." ('Challenge North Leigh' focus group)

> R19(NL): "Depending on what it is, I would probably go and have a word with R7 (NL) first, because he's there.
> R18(NL): He's your neighbour.
> R19(NL): He's my neighbour, yeah." (North Leigh, Resident focus group 3)

> R2(SA): "I think I've had conversations in the pub as well, when one of the pubs have had new light bulbs or something had happened in the pub you do just start talking about it, it's like ooh they are saving electricity in the pub." ('Get Smart with St Athan' focus group)

> R9(AL): "I think it's good, the people we're getting now [from Alyth]... who are asking questions, who maybe – they're not really interested in the form [the Home Energy Check], they don't want the report [from EST], they don't want to be bothered with the questionnaire, but they do want the advice." (Alyth Energy Challenge focus group)

> R2(AL): "A lady came to visit I had a visitor who went through various things, helpful tips.
> Megan: Where was she from?
> R2(AL): Alyth." (Altyh, Resident focus group)

There are also indications that at least one focus group participant would not necessarily seek information from neighbours:

> R4(AL): "You might discuss things with other people and say I am doing this what are you doing, but I don't think you would go around to your neighbour and ask their advice." (Altyh, Resident focus group)

Though Darley (1978) found that that sociometric networks are more important than spatial networks in diffusing energy-conserving innovations, and most current literature does not expect social networks to be confined to geographic locations (Wellman 2001; Day 2005), the hypothesis here assumed that maybe those networks might overlap, particularly considering the nature of the SSE intervention. Though there is no direct evidence to support the hypothesis, particularly in North Leigh and St Athan, the low responses to this question (see Appendix K) and the qualitative findings make the author hesitant to fully accept the null hypothesis. The findings do not necessarily indicate that people would avoid asking community members, but more likely indicates the trend for interpersonal networks to function on a place-to-place (i.e. inter-neighbourhood) basis, rather than on a door-to-door (i.e. intra-neighbourhood) basis (Wellman 2001). As mentioned in the discussion of Hypothesis 2 (section 8.4.1.2),

[189] Uncertain of exact respondent, as voices were difficult to distinguish on the recording, but believe it may be this person.

however, there does seem to be some qualitative indications that community members trust, or begin to trust over time, the 'intermediaries' or experts within the village. Table 8-35 generally summarises the findings from this hypothesis, however, further research would be necessary to more fully understand community residents' tendencies for seeking information during community-level interventions.

Table 8-35: Hypothesis 5a confirmed?

Hypothesis	North Leigh	St Athan	Alyth
H5a: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with those in the same geographic location.	No	No	No

8.4.3.3 Hypothesis 5b: Strength of ties

A hypothesis was formed to address the strength of tie that exists between the respondent and the people from whom the respondent seeks information:

> **H5b**: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with strong ties.

Table 8-36 shows the Fisher's exact test result statistics of the crosstabulations (2x2 tables) between the independent variable, strength of tie with the first named alter (i.e. weak or strong),[190] and the dependent variable, adoption of at least one innovation from each innovation category (i.e. adopted or did not yet adopt).

Table 8-36: Statistical results of the Fisher's exact tests between adoption and the strength of tie with the first named alter

	North Leigh	St Athan	Alyth
WWDF	0.557	1.000	1.000
Visual	0.359	0.402	0.391
AHL	1.000	1.000	0.329
Behaviour	0.524	1.000	0.443

In every village and for every innovation category, there were no statistical results that demonstrated a significant association. These tests indicate that there were no great differences in the answers, but it does not explain exactly who people were contacting. In order to understand this in more detail, Figure 8-23 graphically displays the findings of the findings of the contingency tables for WWDF.

[190] Only the first alter is displayed here, as the number counts were very low for the second and third alters. All frequencies are in Appendix K.

Figure 8-23: Status of adoption for WWDF innovation and strength of tie (Alter 1)

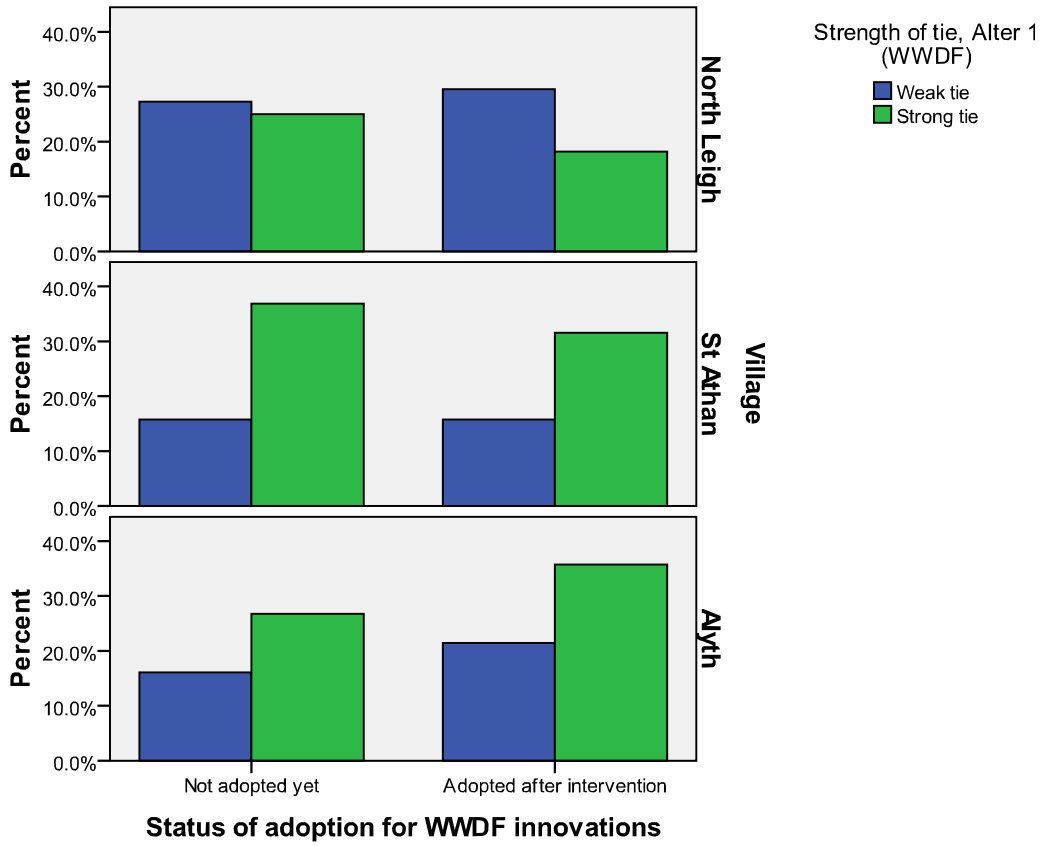
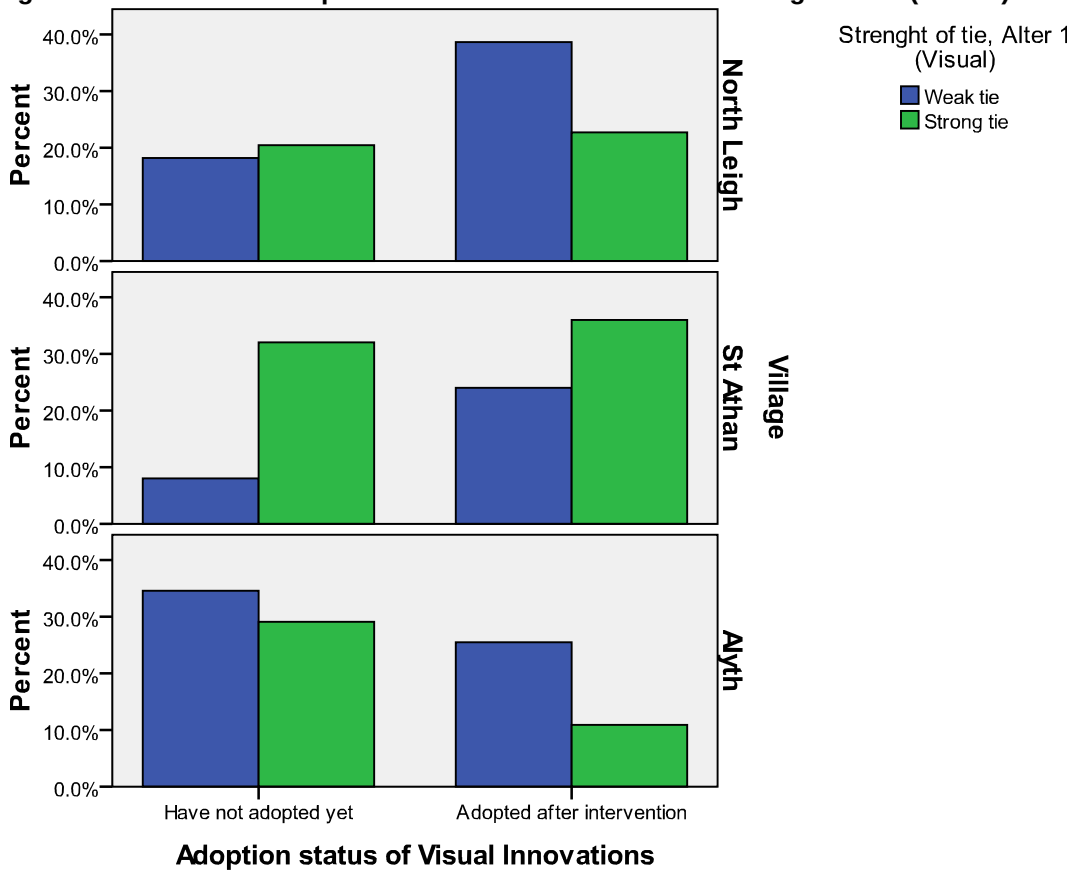


Figure 8-23 indicates that in North Leigh, there were a few more who spoke to weak ties than strong ties of those who adopted an WWDF innovation after the intervention. In St Athan and Alyth, respondents approached more strong ties than weak ties, regardless if they had adopted a WWDF innovation or not.

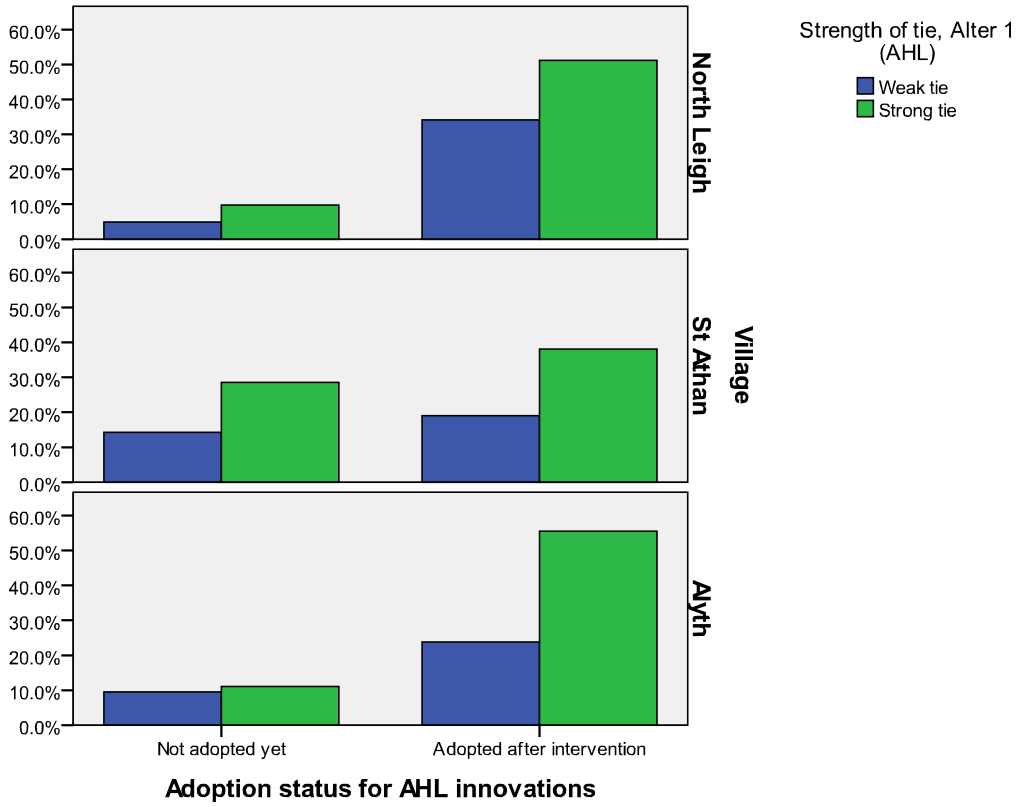
For Visual displays, Figure 8-24 shows slightly different results.

Figure 8-24: Status of adoption of Visual innovations and strength of tie (Alter 1)



In North Leigh, those who adopted a Visual innovation were only slightly more likely to contact weak ties, and contacted more strong ties than weak ties if they did not adopt a Visual innovation. In St Athan, respondents indicated mobilising 'energy social capital' more with strong ties, regardless of adoption status, and the opposite was true in Alyth.

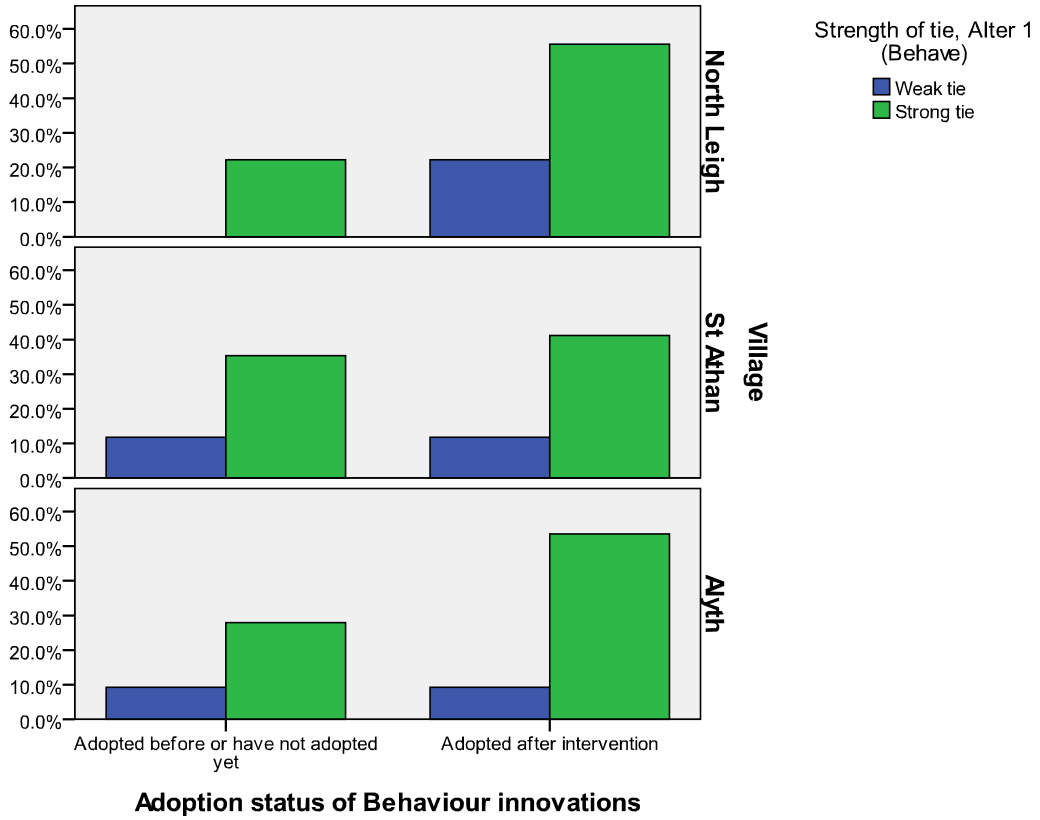
Figure 8-25: Status of adoption for AHL innovations and strength of tie (Alter 1)



For AHL innovations, respondents in each community reported more instances of mobilising 'energy social capital' with strong ties, regardless of adoption status. The percentage of respondents who indicated adopting was much higher than those who indicated they had not yet adopted, in both North Leigh and Alyth.

Similarly, for the innovation category of Behave, more respondents indicated mobilising 'energy social capital' with strong ties than with weak, regardless of adoption or non-adoption.

Figure 8-26: Status of adoption for Behave innovations and strength of tie (Alter 1)



In summary, though there were no significant tests of association which resulted from the chi-square tests, the visual depictions reveal that there were variations in the strength of tie which the respondent approached for information that seemed to largely vary by innovation, and sometimes by adoption status. In North Leigh, those who indicated that they adopted a WWDF or Visual innovation after the point of intervention demonstrated a leaning toward mobilising 'energy social capital' with weak ties. There is some qualitative evidence to suggest that the respondents in the North Leigh focus groups would speak to weak ties, such as neighbours or others in North Leigh, colleagues and acquaintances, in addition to strong ties.

<u>Weak</u>

R14(NL): "I had the chap along and we've had more insulation put in. He went around the house and so on. I found that very helpful ... I think it was someone from the electricity [supplier]. Yeah. They recommended one or two firms." (North Leigh, Resident focus group 2)

R9(NL): "It's like my neighbour, he was happy to just chat to me about it and then he took another step." ('Challenge North Leigh' focus group)

<u>Weak & Strong</u>

R1(NL): Regarding energy efficiency incorporating into renovations: "Yes, spoken to the supplier. Spoken to my builder. Spoken to the, I had a conversation with the engineer at work.
R5(NL): And your wife?
R1(NL): And my wife? Yes. [Laughter.] Certainly." (North Leigh, Residents focus group 1)

Strong

Megan: "My next question is just about your last conversation about energy efficiency, if you can remember. What was the last thing you talked about with somebody and who did you talk to?"
R17 (NL): "My boyfriend wanted to run off with my meter." [Laugh.]
Megan: "The cost meter?"
R17 (NL): "Yeah. Absolutely." (North Leigh, Residents Focus group 3)

The second comment above demonstrates a combination of speaking to weak ties (namely, organisational sources) and also strong ties, the latter of which seemed an almost after-thought in the comment. The quantitative findings from investigating the crosstabulation data indicated that, for AHL and Behave innovations, respondents were more likely to report mobilising 'energy social capital' with strong ties. There was one comment regarding other instances of speaking with immediate family members:

R13 (NL) – "It was interesting talking to a young family at one of these events that we had here. And the mum said, 'Well we decided to do our bit and we sat down as a family.' Now with two children and mum and dad are all sitting round together, and they decided that there was so many electrical gadgets round the house that they would try switching off one or two of them. And of course with the current cost monitor they could see the effect. And the effect was so startling that it's changed their way of life. And it just needed that." ('Challenge North Leigh' focus group)

In St Athan, respondents indicated that they were more likely to mobilise 'energy social capital' only with strong ties, regardless of the innovation, according to the prediction of the hypothesis. Just as the results from Hypothesis 3 indicated that St Athan residents were more likely to potentially contact strong ties, this demonstrates that residents do indeed act on these indications and report mobilising 'energy social capital' with strong ties, as well. The qualitative findings demonstrate that focus group participants spoke with either family members or people who came into their homes (see second comment).

R4(SA) – "Yeah [I have conversations about energy] with my wife and my son when I go around switching everything off." ('Get Smart with St Athan' focus group)

R4(SA) – "We have quite a throughput of people in our house, especially at coffee time or whatever and we are using the eco-kettle and that's quite a topic of conversation when people see it for the first time and when they try and use it for the first time as well and they don't know what they are doing." ('Get Smart with St Athan' focus group)

Megan: "Who do you speak to about that? Your family or friends?
R10(SA): Well, it's family isn't it. It's got to be."(St Athan, Resident focus group)

There were also comments about weak ties being approached, namely those in the group (at an event) and the SSE adviser who had recently started working in the village.

> R2(SA) – "And it's only when we've held events like that, that people have come and just come to talk to us, 'what is it about? what you giving away?' [laughter] and sort of, leaflets. I don't think we've been approached by anyone other than at an event really." ('Get Smart with St Athan' focus group)
>
> Megan: "So what does [SSE NAME] do now, does he go house to house, or does he...?
> R5 (SA): Yeah, he picks up enquiries, he goes into the library.
> R4 (SA): He does a surgery in the library." ('Get Smart with St Athan' focus group)

In Alyth, respondents indicated that they were more likely to mobilise 'energy social capital' with strong ties for WWDF, AHL and Behave innovations. However, for Visual innovations, respondents were more likely to report mobilising 'energy social capital' with weak ties. The qualitative evidence seems to indicate that those promoting the 'street-by-street' campaign were approached for information, though there was rarely mention of exactly which innovation it regarded. However, there were some comments about smart meters and current cost monitors, which seemed to be directed largely at organisations, though the last comment indicates getting at least some information from friends:

> R14 (AL) – "[SSE have] still got people on the phone asking for smart meters." ('Alyth Energy Challenge' focus group)
>
> R4(AL): "I have got friends when I got that little monitor thing said why we haven't got one and got onto the Hydro board and said where is ours." (Alyth, Resident focus group)

It does appear again that there are differences in the strength of tie of alters whom respondents approach according to innovation type. From examining crosstabulation data (see Appendix K), respondents in all three villages were more likely to report approaching strong ties for AHL and Behave innovations. Comparing these findings to the Energy Efficiency Resource Generator, this seems to parallel the findings in North Leigh and St Athan, respondents indicated they would approach more strong ties when asked if they knew anyone who *...would give you sound advice on purchasing energy efficiency appliances for your kitchen?*. The Behave question in the Energy Efficiency Resource Generator does not really seem to match the findings here, except in St Athan, where strong ties were indicated as the preference. In North Leigh and Alyth, respondents indicated that those who had adopted visual display innovations had sought information more from weak ties. As mentioned above, this may be because these are new innovations which were being deployed, and therefore it was not expected that family members or friends would necessarily know about the innovations (and were therefore not contacted as much), or perhaps they had been approached before the time period of the intervention.

Overall, the statistical results do not appear to support the hypothesis, particularly for North Leigh or Alyth, but visual depictions of the data indicate that the results from St Athan appear to parallel Weenig & Midden's (1991) strong tie findings, lending support

to the research hypothesis in that community (summarised in Table 8-37). Further studies could help clarify the associations between the adoption of different innovations and the preferences for mobilising 'energy social capital' with strong or weak ties.

Table 8-37: Hypothesis 5b confirmed?

Hypothesis	North Leigh	St Athan	Alyth
H5b: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with strong ties.	No & Yes, depending on innovation	Yes	No & Yes, depending on innovation

8.4.3.4 Hypothesis 5c: Homophily

The next hypothesis investigated the effect of homophily on mobilisation of energy social capital:

> **H5c**: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with homophilous ties.

Homophily is the degree of similarity that exists between an ego and given alters (McPherson et al. 2001). For the purpose of this research, four common attributes were asked of both the respondent and up to three named alter: age group, gender, marriage or partner status, and education level.

Cross-tabulations were performed to determine the degree of similarity between the respondents and alters. Chi-square statistics are presented. Table 8-38 presents the significance results of these tests, all chi-square significance tests (unless indicated as a Fisher's exact test).[191]

[191] If the cross-tabulation was a 2x2 table and it violated the assumptions of chi-square tests (i.e. expected frequencies were less than 5 in any cell), then a Fisher's exact test was performed.

Table 8-38: Chi-square tests of significance for homophily between respondent and three alters

Homophily variables		North Leigh			St Athan			Alyth		
		χ^2	***df***	**Sig**	**χ^2**	***df***	**Sig**	**χ^2**	***df***	**Sig**
Age *(recode)*[c]	Alter 1	8.133	2	0.017*	3.368	4	0.498	3.789	2	0.150
	Alter 2	-	-	-[a]	6.861	4	0.143[a]	-	-	-[a]
	Alter 3	4.499	2	0.105[b]	0.281	2	0.869[a]	-	-	-[a]
Gender	Alter 1	0.18	1	0.672	0.002	1	0.967	2.666	1	0.103
	Alter 2	2.56	1	0.110	2.779	1	0.095	2.854	1	0.091
	Alter 3	1.375	1	0.241			0.673	20.73	1	0.150
Married or a couple	Alter 1	0.319	1	0.572	.269	1	0.716[b]	1.915	1	0.166
	Alter 2	.326	1	0.675[b]	.781	1	0.481[b]	1.512	1	0.219
	Alter 3	.394	1	0.609[b]	.195	1	1.000[b]	0.294	1	0.588
Education *(recode)*[d]	Alter 1	2.243	1	0.134	5.207	1	.042*[b]	10.26	1	0.001**
	Alter 2	9.738	1	0.002**	.509	1	0.464	7.891	1	0.005**
	Alter 3	3.882	1	0.049*	.691	1	1.000	2.648	1	0.104

*p<.05, **p<.01, ***p<.001

[a] Violates assumption of chi-square test (more than 20% of cells have expected frequency <5); test not reliable

[b] Fisher's exact test

[c] Age groups: 16-44 years; 45-64 years; 65+

[d] Education groups: degree level or above; less than degree level (i.e. other qualifications and no qualifications)

Chi-square and Fisher's exact tests display significant results when there is a significant difference between expected and actual frequencies across the cells of a cross-tabulation. One conclusion is that a significant difference would be equivalent to heterophily, i.e. dissimilarity between expectations and reality. Conversely, the logic would indicate that non-significant results would be an indication of homophily. However, examination of the tabulated data indicated that this was not always the case. For example, the results of the chi-square test reveal the age of respondents in North Leigh were significantly related to the age of the first person they spoke with (Alter 1) ($\chi^2(2) = 8.133$, $p<.05$) , whereas there was no significant association in St Athan ($\chi^2(2) = 3.368$, $p=.50$) or Alyth ($\chi^2(2) = 3.789$, $p=.15$). If significance were a sign of heterophily, then we would expect respondents in North Leigh to be approaching people of more *dissimilar* ages, and respondents in St Athan and Alyth to approach people of more similar ages. However, as data depicts in Appendix K, a significant difference determined from the *p*-value does not appear to be associated with homophily or heterophily.

Examining each homophily variable more closely, regardless of the statistical result, respondents in each village indicated asking more men than women, in general, though this progressively changed with each reported alter. More men were reported as being contacted for Alter 1; however, respondents in St Athan contacted more female alters in their 2nd and 3rd reports of mobilising 'energy social capital'. Those in North Leigh

and Alyth also reported that Alters 2 and 3 were more likely to be women. All respondents tended to mobilise 'energy social capital' with alters who were reportedly married or in a couple, which demonstrates equal amounts of homophily (for those who also reported they were married or in a household with a couple) and heterophily (for those who did not report being married or in a household with a couple). Respondents appeared to indicate a degree of homophily regarding education, but only with the first alter; the findings were more heterophilous for Alter 2 and Alter 3.

Chi-square tests yielded initial comparison information regarding the homophily between the respondent and the people with whom they mobilised 'energy social capital'. A further test was performed in order to address the hypothesis, i.e. the association between homophily and adoption of energy-reducing innovations. This comparison is not as straightforward as other comparisons in this chapter, as the homophily information is not directly linked to one innovation category. Homophily questions were asked at the end of the questionnaire, in order to avoid burdening the respondent with a lengthy questionnaire and to avoid item non-response. Respondents were not given any restrictions on whom to name at the end. As it happened, many respondents did not name anyone throughout the questionnaire, but then filled in the questions at the end, i.e. those used to determine homophily. It is not clear why this happened, but in any case, these answers cannot be linked back to instances of adoption in a specific innovation category. However, even when respondents followed the instructions, they often named a person with whom they had mobilised 'energy social capital' for multiple innovation categories. This made aggregating data and comparing to a specific innovation category almost impossible. Therefore, an approximate test was used to determine the relationship between general homophily levels with general adoption levels. Three new homophily variables (i.e. one variable for each of the three named alters) were created which counted the number of ways in which a respondent was similar to an alter. If the respondent and alter did not share any of the same characteristics (i.e. they were different in age, education level, gender and marriage or living as a partner status), they were scored a 0. If they were similar on one variable, they scored a 1, and so forth. This means the final variables ranged from 0 to 4, with 0 indicating full heterophily and 4 indicating full homophily.

Correspondingly, an adoption variable was created which counted the number of adoptions a respondent had indicated, based on the created adoption variable. If a respondent had adopted at least one (and up to 9) WWDF innovations, but did not adopt any innovations in the other three categories, they were assigned a 1. The resulting scale also ranged from 0 to 4, with 0 indicating no adoptions and 4 indicating

at least on adoption for each of the 4 innovation categories. These new variables were tested for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests. All of the variables were significant at $p<.05$, which means the distributions were significantly different from normal distributions, i.e. not normal (Field 2005).[192] As the variables were all continuous, the Spearman's correlation coefficient (r_s) was derived. This is a non-parametric test which assigns a rank to each value and then applies Pearson's equation. Pearson's equation[193] (Equation 4) "convert[s] the covariance[194] of two variables into a set of standard units" (Field 2005, p.110), where s_x is the standard deviation of the first variable and s_y is the standard deviation of the second variable.

Equation 4 (from Field 2005, p.111)

$$r = \frac{cov_{xy}}{s_x s_y} = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{(N-1)s_x s_y}$$

The standardisation of the covariance results of Spearman's correlational coefficient (r_s) ranges between -1 and +1. The results are presented in Table 8-39.

Table 8-39: Spearman's correlational coefficient (r_s) test for adoption and homophily scale with each alter

Village	Alter 1	Alter 2	Alter 3
	r_s (sig)	r_s (sig)	r_s (sig)
North Leigh	-0.037 (0.389)	0.209 (0.104)	-0.464 (0.006)**
St Athan	-0.294 (0.118)	0.248 (0.178)	0.320 (.184)
Alyth	-0.034 (0.391)	-0.117 (0.205)	0.189 (0.125)

**$p<.01$

The Spearman's tests show that the only significant relationship is between adoption of energy-reducing innovations and homophily between the North Leigh respondents and Alter 3 with whom North Leigh respondents seek information (r_s = -0.46, $p<.01$). This is a negative relationship, which means that as adoption levels increase, homophily levels decrease (or conversely, heterophily increases), which does not support the expected findings of the hypothesis.

[192] The Kolmogorov-Smirnov and Shapiro-Wilk test for Alter 3 in St Athan actually yielded a value of $p>.05$, which is indicative of a normal distribution. Field (2005) indicates that though the Kolmogorov-Smirnov and Shapiro-Wilk test are indicative, they have limitations, concluding by saying: "by all means use these tests, but plot your data as well and try to make an informed decision about the extent of non-normality" (p.93). In this case, examining the kurtosis (-.896) and skewness (-.272), which are both very far from the value of 0 which indicates normal data (which may have resulted from an extremely low frequency count), a judgement was made by the researcher that the distribution was not, in fact, normal and the same non-parametric test was performed on the variable.

[193] Pearson's equation is not suitable for ordinal or non-normal interval data (Field 2005), which is why it is not used directly here.

[194] Covariance is "a measure of the 'average' relationship between variables" (Field 2005, p.727).

There was only one direct comment in the qualitative results across all three communities that applied to homophily, and it indicated a tendency to approach homophilous people for energy information, though not as it was measured here.

> R1(NL): "I'd probably trust local people who live close to me, and who have the same kinds of concerns and irritations." (North Leigh, Residents focus group 1)

Johnson Brown & Reingen (1987) found evidence that those who activate interpersonal communication to seek referral information are significantly more likely to seek homophilous ties, which has not been shown as it was operationalised here. However, Johnson (2004) found that amongst the rural poor in Mongolia, respondents searching for information on critical incidents chose people who were generally heterophilous in terms of age and marital status, which she attributed to the 'strength of weak ties' principle. Homophily is often equated to 'strong ties' (Johnson 2004; Lin 2001b), i.e. those with whom a person feels quite close to are often considered 'people like me' (homophilous). Certainly it is conceivable to consider 'strong' ties as 'like me' in terms of background and exposure to particular social norms and behaviours, and even in age, gender, marital status and education. However, homophily variables yielded inconclusive results in this research, and would need further study to confirm the hypothesis in each community.

Table 8-40: Hypothesis 5c confirmed?

Hypothesis	North Leigh	St Athan	Alyth
H5c: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with homophilous ties.	No	No	No

These statistical findings failed to confirm that there is a relationship between the homophilous qualities of alters with whom a potential energy efficiency adopter seeks information. It is possible that the method of data collection influenced the findings. Future studies should therefore consider revising the method of seeking information on homophily. Future studies should therefore consider revising the method of seeking information on homophily. Respondents often only indicated names in section F of the questionnaire, which meant the Alters could not be associated with any given adoption. As well, it was not possible to directly compare the homophily that existed between the respondent and the named alters to certain innovation categories. Further, the only indication of homophily from the focus group statements was based on people having the same concerns and irritations. Perhaps other homophilous qualities should be investigated, such as similar building types and building ages between respondent and the person with whom they seek information, in addition to similar areas, weather patterns, etc.

8.4.3.5 Hypothesis 5d: Multiple sources of information

There is theoretical evidence to suggest that seeking information from multiple people on the topic of energy efficiency will influence the rate of the diffusion of innovations, and ultimately adoption (Darley & Beniger 1981). In order to investigate this theory, a hypothesis was formed:

> **H5d**: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with a greater number of reported ties.

This hypothesis was tested using two variables. The first variable indicates the number of people with whom the respondent mobilised energy social capital. This variable was determined by counting the number of people listed for each of the four innovation categories. The second variable is the status of adoption, i.e. adopted or not (yet) adopted.

Table 8-41 presents the raw data. It is clear that the majority of respondents who adopted at least one innovation per category did not indicate speaking to anyone about the innovation category in question.

Table 8-41: Frequencies according to adoption by innovation category and the number of people approached

		North Leigh				St Athan				Alyth			
		None	One	Two	Three	None	One	Two	Three	None	One	Two	Three
WWDF	Adopted	45	7	8	7	35	3	2	5	75	8	8	19
	Not yet adopted	74	11	3	9	69	3	4	4	160	13	3	11
Visual	Adopted	71	26	6	7	36	6	2	9	86	16	6	7
	Not yet adopted	98	14	2	3	121	7	3	2	316	24	6	18
AHL	Adopted	105	21	8	8	69	7	1	4	197	29	9	18
	Not yet adopted	50	3	0	3	59	2	1	6	96	7	1	7
Behave	Adopted	138	7	4	3	74	3	2	5	190	14	2	17
	Not yet adopted	67	4	0	0	83	2	2	5	218	6	3	9

In order to understand further if there is an association between the number of people the householder sought information from (i.e. mobilised 'energy social capital' with, the independent variable) and adoption (dependent variable), a logistic regression was performed. A logistic regression is a "multiple regression but with an outcome variable that is a categorical dichotomy and predictor variables that are continuous or categorical" (Field 2005, p.218). Logistic regression is best understood in relation to linear regression. Simple linear regression, for example, predicts an outcome (*Y*) based on fitting data to a straight line, as in Equation 5. Linear regression attempts to *predict* the value of *Y*.

Equation 5 (from Field 2005, p.219)

$$Y_i = b_0 + b_1 X_1 + \varepsilon_i$$

In Equation 5, b_0 is the Y-intercept, b_1 is the beta coefficient and is the gradient of a line, X_1 is the value of the independent variable and ε are the residuals, or error (Field 2005). In linear regression, b_1 represents the change in the dependent variable for every one unit change of the independent variable. Linear regression is based on certain assumptions of the variables, namely that the outcome (dependent) variable is continuous (Koutoumanou & Wade 2010). If the outcome variable is binary or dichotomous, e.g. yes/no, adopted/did not adopt, then linear regression is not appropriate.

Logistic regression uses odds ratios and natural log transformations to ultimately predict the *probability* of an event occurring (Koutoumanou & Wade 2010), i.e. *Y* in Equation 6.

Equation 6 (from Field 2005, p.220)

$$P(Y) = \frac{1}{1 + e^{-(b_0 + b_1 X_1 + \varepsilon_i)}}$$

Logistic regression also has a beta coefficient outcome, but it is based on the odds of an event occurring. When a natural logarithm is applied to a dependent variable value, it is transformed. It must then be exponentiated ('anti-logging'), which yields the beta coefficients (exp *b* in Equation 5), which is the odds ratio (Arkesteijn & Oerlemans 2005). The Wald statistic[195] is the key indicator which indicates whether the exp *b* is significantly different from zero (Field 2005), though must be cautiously interpreted because the standard error tends to inflate when the regression coefficient is large (Field 2005, p.224; Menard 2002, p.43). The most important interpretation is with the exp *b* which is the odds ratio, or "the change in odds. If the value is greater than 1 then it indicates that as the predictor increases, the odds of the outcome occurring increase" (Field 2005, p.241). For example, exp *b* in North Leigh for Visual displays in Table 8-42 is 1.801. This means that for each additional person the respondent speaks to, the odds of adopting a Visual display are 1.8 times greater. The model chi-square statistic "measures the difference between the model as it currently stands and the model when only the constant was included" (Field 2005, p.237). If the model chi-square is

[195] The Wald statistic is calculated by dividing the beta coefficient by the standard error and has a chi-square distribution. In SPSS 17.0, the result is then squared, which is the statistic presented here.

significant (i.e. $p<.05$), the model is predicting awareness of the programme "better than it was with only the constant included" (Field 2005, p.238). The constant beta-coefficient (B) is included in Table 8-42, along with its standard error (SE) for reference.

There are a number of ways to estimate the fit of the resulting model. A goodness-of-fit refers to "an index of how well a model fits the data from which it was generated" (Field 2005, p.732). In linear regression, the patterns of residuals can indicate how well the data fit (Koutoumanou & Wade 2010). For logistic regression, where residuals do not function in the same way, there are a number of ways to test the fit of the model. Firstly, -2 * log-likelihood (-2LL) is a deviance measurement (Koutoumanou & Wade 2010). "Large values of the log-likelihood statistic indicate poorly fitting statistical models" (Field 2005). This is related to the model chi-square, which should be significant if the model with the variable is a better fit than the model without the variables (Arkesteijn & Oerlemans 2005). Secondly, there are "pseudo R square" statistics produced by Cox & Snell R Square and the Nagelkerke R Square. Cox & Snell R Square is based on the log-likelihood of the model compared to the log-likelihood of the "original model" (Field 2005, p.223). It never reaches a theoretical maximum of 1, so Nagelkerke's R Square is suggested as an additional test.

The results are presented in Table 8-42; the most important numbers to note are the Wald statistic and the exp *b,* with the significant results in bold.

Table 8-42: Logistic regression of adoption and number of people approached for advice

	Model				Goodness-of-fit		
	Constant B (SE)	Wald	exp *b* (95% CI)	Model χ^2	-2LL	Cox & Snell R^2	Nagelkerke R^2
North Leigh							
WWDF	-.483 (.183)	1.664	1.229 (.898,1.682)	1.670	220.170	0.010	0.014
Visual	**-.207 (.154)**	**8.621****	**1.892 (1.236,2.897)**	**10.261****	**291.933**	**0.046**	**0.061**
AHL	.805 (.170)	2.714	1.502 (.926,2.437)	3.248	232.611	0.016	0.023
Behave	.702 (.148)	1.958	1.847 (.782,4.361)	2.643	276.396	0.012	0.017
St Athan							
WWDF	-.672 (.204)	1.499	1.289 (.858,1.936)	1.488	161.866	0.012	0.016
Visual	**-.721 (.217)**	**11.046****	**2.056 (1.344,3.146)**	**12.929*****	**187.848**	**0.079**	**0.110**
AHL	.204 (.175)	0.239	0.904 (.604,1.354)	0.240	205.183	0.002	0.002
Behave	-.105 (.159)	0.087	1.061 (.717,1.568)	0.087	243.357	0.000	0.001
Alyth							
WWDF	**-.759 (.137)**	**14.328*****	**1.618 (1.261,2.076)**	**15.177*****	**376.424**	**0.050**	**0.068**
Visual	.215 (.130)	2.725	1.240 (.961,1.600)	2.632	481.983	0.006	0.009
AHL	.757 (.123)	1.807	1.225 (.91,1.645)	1.948	445.769	0.005	0.008
Behave	**-.120 (.098)**	**4.229***	**1.316 (1.013,1.709)**	**4.459***	**631.482**	**0.010**	**0.013**

**p*<.05, ***p*<.01, ****p*<.001

For the innovation category of 'Visual displays', North Leigh and St Athan demonstrated significant results, although the pseudo R^2 measures are fairly low. In Alyth, significant results resulted from the WWDF and Behaviour models, though each again has a low pseudo R^2. The data is interpreted as such: in North Leigh, for each additional person the respondent speaks to, the odds of adopting a Visual display are 1.8 times greater. In St Athan, for each additional person the respondent speaks to, the odds of adopting a Visual display innovation are 2.27 times greater. And in Alyth, for each additional person the respondents speaks to, the odds of adopting a WWDF innovation are 1.62 times greater and the odds of adopting a behavioural change innovation are 4.23 times greater. The low pseudo R^2, however, means that the results do not appear to account for a high degree of variability in the model.

There were a few statements from the focus group participants, particularly in North Leigh and Alyth, spoke with more than one person when considering adopting an energy-reducing innovation, although the comments do not include information on which innovations these multiple conversations regarded.

> R9(NL) – "My neighbour, I went round and R8(NL) was sitting in there with a cup of tea busy talking to my neighbour. Helping him to understand all sorts of different things and that was really fantastic as well. Because, this is a slight aside from what I was saying, but I've talked to my neighbour a lot and he was interested." ('Challenge North Leigh' focus group)
>
> R18(NL) – "I certainly wouldn't expect to ask just one person. If you've got something you're thinking, you ask around and you get people's experiences as well and of course this energy saving is all very well, but you're never comparing like with like, are you?" (North Leigh, Resident focus group 3)
>
> R9(AL) –"I would say the most effective thing is when, if you've been in to a house, and you've given advice, and it's always good advice, you know, when it's good advice, that that person then speaks to a neighbour." ('Alyth Energy Challenge' focus group)

As Darley & Beniger (1981) indicate in their discussion of the diffusion of energy-conserving innovations: "Often, multiple tellings of some message may be required before acceptance and adoption occur" (p.166). The authors further indicate that mass media may be effective with some innovations, but that people will want to confirm this with trusted advice from a number of social network ties. The fact that mobilising 'energy social capital' with multiple alters was associated with adoption in specific innovation categories lends support to the hypothesis that people may need to hear a message a few times before adopting. It may be that this communication is reducing the uncertainty and perceived complexity of innovations, which are both innovation attributes which otherwise can lead to non-adoption (Rogers 2003). As posed, however, it must be noted that the survey questions simply asked who the respondent approached for information. There are several other ways to gain information on energy-reducing innovations which would also act to reinforce previously heard messages, perhaps through casual conversations, i.e. the expressive returns of social

capital, rather than the instrumental returns, only the latter of which is measured here. Further research would be needed to understand the effect of information gained through non-purposive actions.

In general, the quantitative results provide evidence to accept this hypothesis, though only with certain innovation groups; namely, Visual displays in North Leigh and St Athan, and WWDF and Behave in Alyth, as indicated in Table 8-43.

Table 8-43: Hypothesis 5d confirmed?

Hypothesis	North Leigh	St Athan	Alyth
H5d: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with, a greater number of reported ties.	Yes & No, depending on innovation category	Yes & No, depending on innovation category	Yes & No, depending on innovation category

8.4.3.6 Hypothesis 5e: Positive advice

The final hypothesis addresses the positivity of received energy-related advice:

> **H5e**: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with those who offer positive information.

This was measured by asking respondents whether the advice they received from alters was in favour of the innovation (interpreted as positive advice), neither in favour nor not in favour (interpreted as neutral advice), or not in favour (interpreted as negative advice).[196] Initial frequencies, as illustrated in Table 8-44, indicated that most respondents were receiving positive advice, regardless of village or innovation category, and regardless if it was the first, second or third person with whom they indicated speaking. Initial crosstabulations of this variable with adoption (i.e. the collapsed variable of adopted after intervention, or have not yet adopted) indicated that respondents were getting positive information for both categories: adopted, and not yet adopted. The one category that showed any sort of variation was Visual displays.

[196] There was also an answer category for 'don't know'.

Table 8-44: Frequencies of adoption of visual displays & the positivity of advice received from three alters

Community			Type of advice		
			Positive	Neutral	Negative
North Leigh (Visual)	Alter 1	Adopted	32	0	1
		Not yet adopted	15	1	2
	Alter 2	Adopted	15	1	0
		Not yet adopted	0	2	2
	Alter 3	Adopted	7	1	1
		Not yet adopted	0	1	1
St Athan (Visual)	Alter 1	Adopted	16	0	0
		Not yet adopted	5	1	2
	Alter 2	Adopted	10	-	0
		Not yet adopted	3	-	1
	Alter 3	Adopted	6	2	0
		Not yet adopted	0	0	1
Alyth (Visual)	Alter 1	Adopted	23	3	0
		Not yet adopted	31	3	3
	Alter 2	Adopted	8	3	0
		Not yet adopted	6	12	1
	Alter 3	Adopted	6	0	0
		Not yet adopted	4	9	3

Pearson's chi-square tests of the crosstabulation indicated that the model could not be reported with confidence, as more than 20% of cells had an expected frequency of less than 5 for each test. To avoid this, the variable was recoded into 'positive advice' and 'not positive advice' (i.e. combining neutral and negative advice). Though most of the results had chi-square tests that again indicated a lack of confidence in the results, the 2x2 table was subject to Fisher's exact test with higher confidence. The results in Table 8-45 indicate that each village had at least one significant association in the innovation category of visual. All tests of significance are the Fisher's exact test.

Table 8-45: Fisher's exact tests for adoption and the positive or not positive advice received from each alter

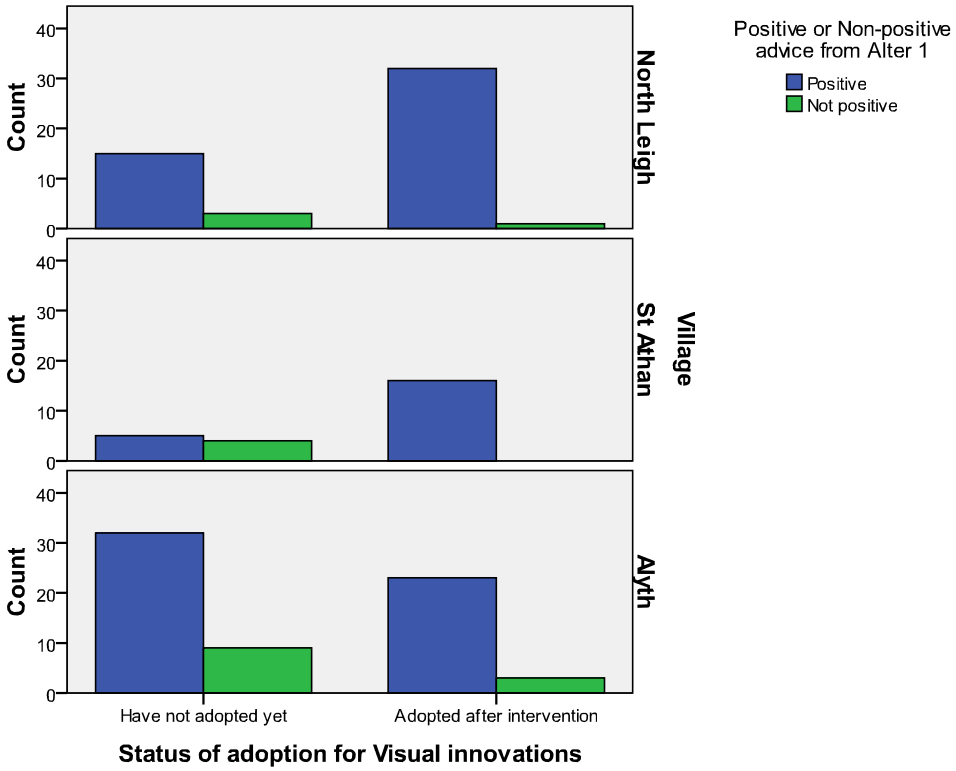
Innovation category		North Leigh	St Athan	Alyth
WWDF	Alter 1	0.410	0.476	0.782
	Alter 2	1.969	0.043	4.216
	Alter 3	-[a]	0.686	0.931
Visual	Alter 1	2.996	6.857*	0.273
	Alter 2	15.000**	2.692	4.739
	Alter 3	4.278	2.250	9.900**
AHL	Alter 1	0.176	0.065	0.691
	Alter 2	6.480	0.244	4.333
	Alter 3	0.637	0.032	1.143
Behave	Alter 1	1.004	0.400	1.451
	Alter 2	-[a]	1.029	4.398
	Alter 3	-[a]	1.742	2.521

*p<.05, **p<.01

[a] No counts for 'not positive'

Figure 8-27 visually represents the results of the re-coded 'positive' variable and adoption status for Alter 1. The findings for St Athan demonstrated a significant association, as per the Fisher's exact test.[197] The difference is evidently from the fact that those who had not adopted received almost equal amounts of positive and non-positive advice, whereas those who adopted only received positive advice.

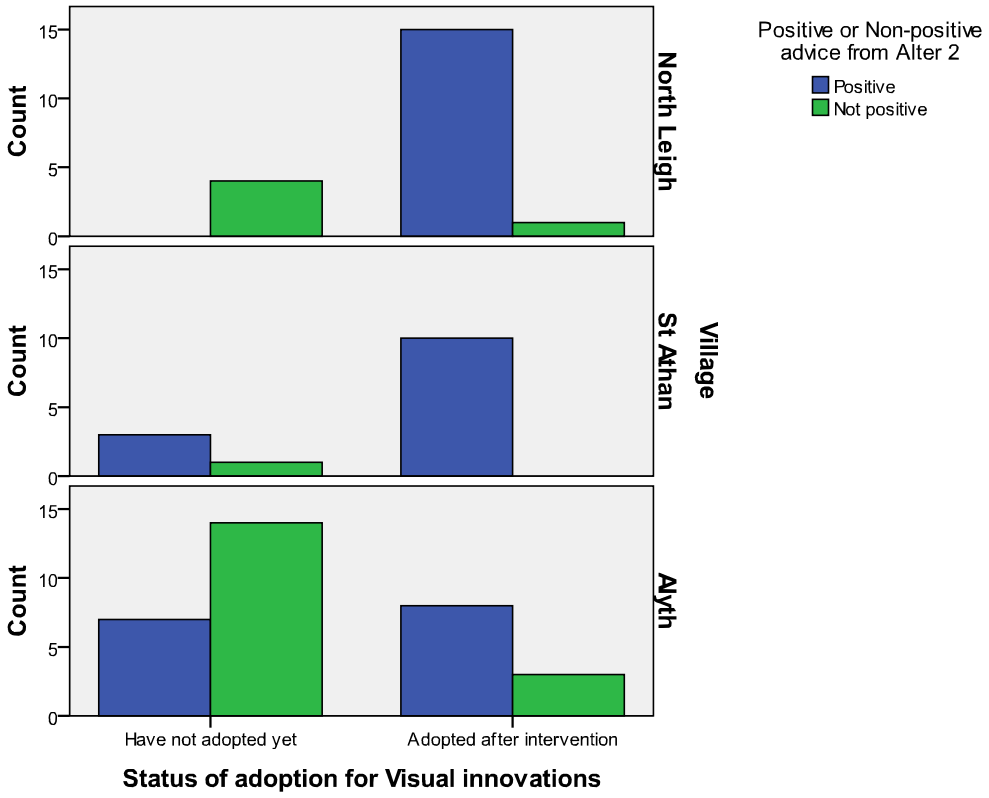
Figure 8-27: Status of adoption and positivity of advice (frequencies), Alter 1



[197] An odds ratio could not be obtained due to a zero value in one of the cells.

In Figure 8-28, the same results are presented for Alter 2. In this graph, the tests of association were significant for North Leigh (p=.001). Though Alyth did not yield a significant Fisher's exact test result, it did yield a significant chi-square test result ($\chi^2(1)=4.739$, $p<.05$, odds ratio: 5.33 (95%ci(1.079,25.884)).[198] In North Leigh and Alyth, respondents report more non-positive advice if they had not yet adopted, and more positive advice if they had adopted a Visual innovation.

Figure 8-28: Status of adoption and positivity of advice (frequencies), Alter 2



The positive advice associated with the adoption of visual innovations parallels the findings in a Dutch experiment which found that adoption decisions were significantly related to positive advice (generally from strong ties) and non-adoption decisions were related to negative advice (Weenig & Midden 1991). This is not necessarily a direct relationship. Fishbein & Ajzen (1975) state that "traditional measures of attitude toward an object can influence a given behavior only indirectly ..." (p.382). Midden & Ritsema (1983) indicate that positive attitudes, for example, may be mediated through normative pressure to conserve energy. It appears that even though most advice was positive, regardless of adoption status, when advice was less than positive for visual innovations, it seemed to be associated with non-adoption, lending support to accepting the hypothesis. The less-than-positive advice surrounding the particular

[198] Though Fisher's exact test is "better than chi-square for two dichotomous variables" (de Vaus 2002b, p.297), they both test the same data, and the data in Alyth did not violate the assumptions of the chi-square test.

innovation category of visual innovations most likely originates from the fact that smart meters and current cost monitors are rather new innovations. As well, there were indications from the author's knowledge of the SSE interventions that there was a 'trial and error' period when the smart meter replacements began, whether these were due to manufacturers delay or miscommunication or technical difficulties, all of which may increase the uncertainty of the innovations for potential adopters.

In summary, though significance tests yielded few significant results, examination of the data indicates that most reports of advice are positive.

Table 8-46: Hypothesis 5e confirmed?

Hypothesis	North Leigh	St Athan	Alyth
H5e: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with, those who offer positive information.	Yes	Yes	Yes

The specific issue of 'positive advice' did not directly arise in the qualitative findings, but related themes of trusted and conflicting advice did. Though it does not directly address the hypothesis, the literature indicates that trusted and conflicting advice are both issues of concern regarding the diffusion of energy-reducing innovations (Costanzo et al. 1986), and they are discussed here briefly. Qualitative statements on this theme arose in the 'Alyth Energy Challenge' focus group, from one respondent in particular (R9(AL)), who was an energy auditor who had been to several houses to offer information and advice.

> R9(AL) – "People who were given wrong advice in the past, like it's ok if you're out at work all day, it's better to keep your heating on, all day, rather than heat your house up from cold when you come home. Because somebody who they had respect for told them that. They carried on doing that." (Alyth Energy Challenge focus group)

> R9(AL) – "Well we've come across a problem with the contractor that's been doing the insulation, because we've happily gone in and explained to people how we think certain measures would improve the energy efficiency of their home. And then the contractor, who was to carry out some other work has given them completely [different] advice, they say, well actually topping up your loft insulation isn't going to save you any money, or draught-stripping that door isn't going to save you any money. Because they're doing the work they want to make a profit, and if they don't see a profit in the work, then they want the person to take off that work. And people will .. I mean, they have come back to us a bit disappointed that the contractor said that. But then they're left trying to decide, have we given them the wrong information, or is the contractor, you've got to battle it to bring those people back." (Alyth Energy Challenge focus group)

> R9(AL) – "One of the other conflicts that we've come across was the number of people who have had heating systems put in without room thermostats. You know, they were told, as far as they were concerned, reliably, by the people putting in the heating system that they don't need a room thermostat. And when I tell them they do need a room thermostat." (Alyth Energy Challenge focus group)

In general, information-seeking is often regarded as a means to reduce uncertainty by "search[ing] for evaluative judgments of trusted and respected others" (Dearing 2008, p.100). The focus groups statements suggest that other people, namely contractors or

installers, had given advice which the street-by-street campaigners in Alyth disagreed with and contradicted, which increased the householders uncertainty. Bartiaux (2008) posits that "consistent information is ... necessary if one is to implement received advice" (p.1178). Bartiaux (2008), in his research which questioned consumers' rationality with regard to the adoption of 'green' lifestyles, describes a hypothetical situation almost exactly like that in the qualitative evidence above, where a person receives conflicting advice on an energy-related matter, and indicates that:

> "these comparisons, as well as the search of consistency within someone's social networks, are a different mechanism than bringing new information to discursive consciousness in order to enable changes" (Bartiaux p.1178).

He further indicates that this 'different mechanism' may be social support. Vollink et al. (2002), in their study of the diffusion of energy-saving programmes, also state that "the intention to adopt may have been influenced by the feeling of being obliged to do something rather than being based upon a positive perception of the intervention..." (p.341). This implies that searching for information is not a straightforward, rational endeavour that operates independently of other motivations such as the need for social support, or feelings of obligation or other normative influence (Midden & Ritsema 1983).

8.5 Summary of findings & limitations of the research

The findings for each hypothesis, as were discussed in this chapter, are summarised in Table 8-47.

Table 8-47: Summary of findings for research questions (RQ) and hypothesis (H)

Research Question	Hypothesis	Community		
		North Leigh	St Athan	Alyth
RQ1: What are the features of the communication structure, and specifically the accessible 'energy social capital', in the diffusion of energy-reducing innovations?	H1: Householders will report that they would be just as likely to access 'energy social capital' as informational sources from non-interpersonal contacts.	Yes	Yes	No
	H2: Householders will be more likely to report accessible 'energy social capital' with contacts living in the same geographic community.	No*	No*	No*
	H3: Householders will report that accessible 'energy social capital' is available more through weak ties than through strong ties.	Yes	No	Yes
RQ 2: Will respondents mobilise 'energy social capital' with everyone they know who can offer energy advice?	H4: Householders will report more accessibility to 'energy social capital' than is actually mobilised.	Yes	Yes	Yes
RQ3: What are the features of mobilised 'energy social capital' and how is it associated with the reported adoption of energy-reducing innovations?	H5: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital'.	Depends on innovation	Depends on innovation	Depends on innovation
	H5a: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with those in the same geographic location.	No†	No†	No†
	H5b: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with strong ties.	Depends on innovation‡	Yes‡	Depends on innovation‡
	H5c: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with homophilous ties.	No	No	No
	H5d: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with a greater number of reported ties.	Depends on innovation	Depends on innovation	Depends on innovation
	H5e: The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital', particularly with those who offer positive information.	Yes§	Yes§	Yes§

* The results of this hypothesis are suspected of being invalid (see section 8.4.1.2)
† The qualitative results of this hypothesis indicate that people may trust people in the same community, even if they are not the indicated choice for information (see 8.4.3.2)
‡ The results of this hypothesis for St Athan are based on examination of descriptive data, rather than statistical tests (see 8.4.3.3)
§ These results are largely based on examination of descriptive data, as there was insufficient data to rely on statistical tests

One limitation was that it appeared that respondents were either reluctant to mention people with whom they had sought advice on energy related innovations, or had trouble recalling names or remembering situations. The qualitative findings indicate that the topic of energy efficiency does not often motivate respondents to seek information from other people, which may explain the low item responses. These low item responses may have affected the statistical tests for Hypotheses 5a-d, particularly as chi-square and Fisher's exact tests are sensitive to the amount of data available, which may affect the conclusion validity. The construct validity and reliability appear to be fairly strong; there were often similar types of responses between communities, and where there were differences, these were often explained through qualitative findings. It is hypothesised that there may have been some sort of social desirability bias in the large number of positive information reports, but this could also be due to the fact that the innovations in question, with the exception of the newer Visual display devices, had already been accepted and did not cause as much uncertainty. Further research would be needed to more fully understand the positive advice findings. The content validity of determining whether an alter was in the same community regarding accessible 'energy social capital' was very low; it is felt that the Energy Efficiency Resource Generator instrument would need to be altered for future studies if it were to be used to gather this type of data again. Further, the internal validity could probably be strengthened with the inclusion of other variables, in order to test true correlation of 'energy social capital' with the adoption of specific energy-reducing innovations. The research that was designed and conducted here, however, is a first step in the process, and findings appear to justify the relationship and the need for further research on social capital and social networks. Though these were case study populations, which necessarily have low or non-existent external validity, the replicability of the three cases does act to support a degree of external validity.

In future, it may be that consideration of different research designs, methods or modes may yield the information which is lacking here. A longitudinal design, for example, may be able to capture the stages of the innovation-decision process as they are happening and track their changes. Further, a carefully constructed field experiment, similar to Weenig (1993),[199] may yield comparative results and enhance the predictive power of outcomes of similar communities. Structured or unstructured face-to-face interviews may also elicit information which may have been lost in the self-completion questionnaire. For example, if a respondent questioned whether or not they should include a certain person's name, they could discuss it with the trained researcher

[199] Weenig (1993) chose two communities which were very similar, using one community to test the use of 'paraprofessionals' and the other as a control.

administering the questionnaire. However, there is also evidence that respondents think face-to-face interviewers seeking information on energy efficiency are "environmental spies", which may reduce response rates (Shipworth et al. 2010, p.53). Careful consideration would be necessary in design, method and modes to ensure that respondents trusted the researcher, or research project, enough to offer information about social networks and energy efficiency adoptions in the home.

In summary, the findings here have helped in understanding the influence of context-specific social capital on the diffusion of energy-reducing innovations within UK communities. Respondents indicated that accessible 'energy social capital' is generally considered when there is a need for seeking information on energy-reducing innovations, and it is often available in social networks outside of geographical boundaries through weak ties, and sometimes strong ties, depending on the community and the innovation. More accessible 'energy social capital' is available than is mobilised 'energy social capital', consistent with the literature (Lin 2001b). The associations between mobilised 'energy social capital' and adoption of energy-reducing innovations often depends on the type of innovation and appear particularly dependent on positive information. There are also indications of reliance on change agents and opinion leaders. Future research should draw on both the findings and the limitations noted above in order to further understand the importance of social capital for the diffusion of energy-reducing innovations and the possibilities for applying the results in other community interventions.

Chapter 9: CONCLUSION

The aim of this research is to understand the influence of context-specific social capital on the diffusion of energy-reducing innovations within UK communities. Previous to this research, there were no known empirical studies specifically examining social capital in relation to the diffusion of energy-reducing innovations. The purpose of the research is based on the Government's aims to increase energy security, eliminate fuel poverty, and reduce the emissions which contribute to global climate change (DECC 2009b). The UK Government has a target of reducing carbon dioxide emissions by 29% from the household sector by 2020 (DECC 2009b), with a growing emphasis on encouraging energy companies and local authorities to work with communities to achieve reductions in given areas (DCLG & DECC 2010; DECC 2010f). Considering past domestic energy consumption and carbon dioxide emission data, and the sometimes slow diffusion of many energy efficiency innovations, as discussed in Chapter 2, trends would need to change for this target to be met.

According to the diffusion of innovation theory, as discussed in Chapter 3, innovations diffuse through a social system when they are communicated through one or more channels over a period of time (Rogers 2003). The communication aspect is important throughout the innovation-decision process, a cognitive process in which adopters are hypothesised to be considering innovations (Rogers 2003). This process consists of five stages, according to Rogers (2003), of first having knowledge of an innovation, then being persuaded to use it, making a decision to adopt or reject the innovation, then implementing an adoption if that is the choice, and finally confirming the decision by continuing to adopt the innovation or deciding to reject it (Rogers 2003). One form of communication is information-seeking, and there is evidence that people tend to seek information to reduce personal uncertainties associated with new innovations (Rogers 2003; Dearing 2008) before they will adopt them. Information-searching via interpersonal social networks is one type of communication utilised by potential adopters for the acquisition of innovation information, and was here considered to be social capital, or the "resources embedded in a social structure which are accessed and/or mobilized in purposive actions" (Lin 1999, p.35). As explained in Chapter 4, social capital is a relatively new concept. The definition, and subsequent operationalisation and measurement, are still highly debated. Two 'branches' were identified in the literature, and research here adopted the definition of 'individual social capital', i.e. the "resources embedded in a social structure which are accessed and/or mobilized in purposive actions" (Lin 1999, p.35). This definition focuses on the returns to an individual. In contrast, the other 'branch' (collective social capital) focuses on

community, trust and reciprocity. This latter 'branch' enjoys a wider use and is more popular, but tends to focus on group-level benefits, which was not the focus of the present research.

The definition of social capital used here is generally discussed and operationalised in terms of acquiring help from people in order to obtain resources that those people do not have (i.e. instrumental returns), or maintain resources already possessed (i.e. expressive returns), and thereby expedite some goal. One goal, or anticipated return for investment in a social network, is information, which is conceptualised as an instrumental return (Lin 2007). The common definition of 'individual social capital' is meant to cover returns to all aspects of life, not just information on energy efficiency. In order to distinguish from the more commonly-researched 'general social capital,' the research here only examined what was labelled 'energy social capital', i.e. those information resources related to household energy use embedded in social networks, and the research questions and hypotheses – as discussed below – were based on this definition.

The operationalisation of 'energy social capital' was based on informational returns, e.g. 'Did you speak to anyone to get information on insulation', etc. This is based on the classic diffusion model which assumes a rather standard process of communication of information about an innovation through a social system over time, leading to adoptions or non-adoptions. It is theoretically useful for interpreting and understanding trends of technology diffusion, but the diffusion model tends to rely on technical knowledge and information which is objective (Kaplan 1999), and supposedly able to be interpreted similarly between people, in the manner of instruction leaflets or demonstrations. This technical information is conceived as being influential during the innovation-decision process. The research presented here was focused on a general understanding of information-seeking, which was most likely understood by respondents in the sense of the 'objective information,' such as the problems associated with cavity wall insulation, or the way a visual display of energy use works, or if something is convenient, etc. However, the qualitative findings particularly seem to indicate that 'lack of information' is not the only reason for not adopting energy efficiency measures. The need for technical information is likely to be one element in information-seeking, information-finding and the processing of information, but decision processes are not necessarily logical or based on objective information. As Stern (1999) summarises:

> "what makes information [about home energy use] effective is not so much its accuracy and completeness as the extent to which it captures the attention of

> the audience, gains their involvement, and overcomes possible s[c]epticism about its credibility and usefulness for the recipient's situation" (p.467-468).

Decisions will be influenced by social norms, opportunities, time constraints, feelings, circumstances, social influence, opinions, motivations, and familiarity (Midden & Ritsema 1983; Kaplan 1999; Scheuer 2007), which might be considered "subjective elements" (Jorde-Bloom 1986, p.194) of information and information-gathering. 'Energy social capital' was a useful research concept, but by definition was only focused on information-seeking. It is suggested that future research on understanding the diffusion of energy-reducing innovations should consider not only the various forms of objective information, but also the diverse types of 'subjective' information.

As described in Chapter 5, three research questions and related hypotheses were formulated according to the model which integrated diffusion of innovation theory and social capital theory within the broader framework of socio-technical household energy studies. Three communities (North Leigh, England; St Athan, Wales; and Alyth, Scotland) established the cases of this multi-case case study and were the focus of research. An energy company (Scottish and Southern Energy) conducted interventions in the communities, promoting standard measures of insulation and behaviour change, along with more novel measures such as the installation of smart meters and energy display devices, and supported community groups in an effort to achieve a 10% reduction in electricity over two years. The community groups in two communities (North Leigh and Alyth) consisted of more or less established networks or environmental groups, whereas the third community (St Athan) created a group specifically for the purpose of supporting the energy company's efforts. In addition, there was an energy company representative based in North Leigh, who worked in parallel with the local 'Challenge North Leigh' Group', and a parallel, separately-funded initiative in Alyth which conducted a door-to-door campaign on insulation. North Leigh and Alyth achieved their 10% electricity reduction as of March 2010, and the results of St Athan have not yet been reported (SSE 2010).

The case study approach was used to conduct primary research, enabling quantitative cross-sectional findings derived from self-completion questionnaires to be contextualised from focus group findings. As discussed in Chapter 6, there are certain paradigmatic tensions that arise when using a mixed methods approach, i.e. the conflicting ontologies, epistemologies and methodologies. The positivist epistemology which quantitative research on has been criticised as being incompatible with the interpretivist epistemology of qualitative, subjective research. As explained in Chapter 6, and as presented in Chapter 8, the results of the quantitative data are the main

source for the findings and evaluation of the hypotheses here. These are then 'complemented' by the qualitative findings of the focus groups. The quantitative findings, and an epistemology which is based more on objectivism, has thus dominated. The mixing of methods here is based on what has been called a 'pragmatist stance' (Greene et al. 1989), which argues that paradigms are independent and that mixing methods should be considered according to the research question. Though the tensions of the often conflicting paradigms are recognised, it is intended for the utility of research design to supersede these in order to present a deeper view of the findings (Bazeley 2002), which admittedly attempts to be rather objectivist but also incorporates a degree of subjectivity to achieve a deeper understanding of the findings.

Chapter 7 explains the methods of data collection for both the quantitative and qualitative research. The sampling for the quantitative research was a census of the sampling frame. The sampling frame was identified by matching names from the electoral register to addresses from the postcode address file, which yielded sampling frames which covered 45.5% of the population in North Leigh, 60.8% in St Athan and 69.2% in Alyth. A 12-page questionnaire was devised according to established methods (de Vaus 2002a; Dillman 2000), and included survey items which measured adoption of several different energy efficiency innovations and energy conservation behaviours in four categories: walls, windows, doors and floors (WWDF, e.g. cavity wall insulation); visual displays of energy use (VISUAL, e.g. smart meters); appliances, heating and lighting (AHL, e.g. low energy light bulbs); and daily behaviours (Behave, e.g. only boiled enough water in the kettle). In addition, the questionnaire elicited information on accessible and mobilised 'energy social capital' indications, as well as socio-demographic details and self-reported knowledge and awareness of home energy use. Accessible 'energy social capital' are those resources located amongst social network contacts which are assumed by the respondent, i.e. potential information sources. Mobilised 'energy social capital' are those resources which have already been accessed amongst interpersonal contacts, i.e. information which has already been sought. It is generally hypothesised that individuals will report more people with whom they can access social capital than with whom they report mobilising social capital (as was confirmed in Hypothesis 4). After pre-testing the questionnaires, they were administered according to the Total Design Method (Dillman 2000), whereby respondents were first sent a pre-letter, followed by the full questionnaire and an incentive of a book of 6 first-class stamps, and then a follow-up reminder/thank you postcard, and finally a replacement questionnaire to those who had not yet responded at that time. All questionnaires were sent during the summer and autumn months of

2009 and response rates achieved were within the expected range of the Total Design Method: 62.4% (North Leigh), 61.3% (Alyth) and 56.4% (St Athan).

The content of the self-completion questionnaires consisted of previously established methods of measuring 'individual level' social capital, but were novel in their combination and applications. A modified resource generator (Snijders 1999; van der Gaag & Snijders 2005), called here the Energy Efficiency Resource Generator, was constructed to elicit information in one domain of everyday life, i.e. the information-seeking involved in changing behaviours and physical structures which have an impact on energy use. The findings, as discussed in Chapter 8, demonstrate that between 45% and 58% of residents, depending on the community, reported they had access to at least one resource, out of twelve possible resources. Further, the results indicate that all or most the twelve questions in the newly-created Energy Efficiency Resource Generator formed one scale of accessible 'energy social capital' with a high degree of reliability in each community. The internal reliability of the Energy Efficiency Resource Generator indicates that it may be a useful method for quickly establishing whether a household could contact someone they know for information. As the UK government often points to a lack of information as one reason for non-adoption of energy efficiency (Defra 2007a), there is potential for this measurement instrument to be utilised in a short survey form, perhaps along with questions regarding information-seeking with non-interpersonal resources, to assist practitioners and policymakers understand where people would potentially look for information, and thus enable better-informed decisions on bridging the information gap. Bearing in mind that there is often a difference between what respondents often say they will do, and what they actually do, this method could potentially be an initial indication of areas in which to strengthen or reinforce information-diffusion.

The quantitative research also employed a set of name generators and name interpreters to measure mobilised 'energy social capital', i.e. resources which had been accessed in the past. The name generator is an established form of collecting social network data (McCallister & Fischer 1978), though has not previously been employed for the purpose of eliciting information on household energy use. The findings show that between 41% and 55%, depending on the community, spoke to at least one person for the purpose of gaining information on energy-reducing innovations. Respondents had the opportunity to indicate speaking to up to 12 people, but there appeared to be a threshold of speaking to a maximum of 6 people. In fact, only 3 of a total of 892 respondents across all three communities indicated speaking to more than 6 people. The reason for this could be due to the questionnaire design, which asked for

the names of people the respondents spoke to in multiples of 3, but could also possibly be due to a cognitive load limit (Lin & Belkin 2005). It is hypothesised that people speak to more people than was reported when considering adoption innovations, but that self-reports were relatively low due to either hesitancy in listing the names or initials of personal contacts (as emerged in the pre-test), through lack of recall, or possibly due to other unforeseen reasons. This hypothesis would need to be tested in future, and might be worth investigating in order to establish an average expected number of people with whom a person can actually seek information on household energy innovations. Further, in future it would be very useful to know with whom (i.e. full names) respondents are speaking, in order to ascertain whether there were opinion leaders with whom most or many respondents indicated seeking information. Respondents in communities may all be speaking to the same handful of people, so knowing the average number of people and who those people are could be useful for practitioners, as it may be that efforts for increasing information in social networks is only necessary up to a certain point.

As designed, the questionnaire was meant to assess the stage of the innovation-decision process which householders had indicated reaching regarding their decision in adopting (or not adopting) various energy efficiency technologies and behaviours. Respondents tended to be clustered around the answer categories which indicated they were either at the beginning of the innovation-decision process or the end of the process. The beginning of the process, 'knowledge' (or lack of knowledge), was here determined by offering an answer category of 'did not consider'. The end of the process, 'confirmation', was determined by asking if the respondent had installed an innovation before or after a given time period, and in the case of visual displays, also separated out those who were no longer using the innovation. There were a series of answer categories between these operationalised concepts of the innovation-decision process (e.g. are you considering the innovation? have you made a decision? have you ordered it?), but answers were largely grouped around these two ends of the spectrum. Therefore, the stages were collapsed into 'adopted' and 'not (yet) adopted,' the latter of which combined most of the categories of the innovation-decision process as operationalised (besides adoption). In future, it may be that qualitative methods would be more appropriate to determine the cognitive processes occurring between knowledge and adoption, or that longitudinal research designs would be able to capture the temporal process. It may also be that further revision of the survey instrument could yield more satisfactory results. On the other hand, it could suggest that the model itself could be altered to more appropriately match the mental models of household decision-making on energy efficiency. There are suggestions that Rogers (2003) innovation-

decision process misses other steps in the cognitive process, such as “tentative adoption” (Jorde-Bloom 1986, p.195), and that the model should actually be re-configured to put familiarity and interest in the innovation at the centre of the process, rather than information (Kaplan 1999). The final results of the research here do not fully explain whether it is the theory or the method which may need revision to more fully capture the innovation-decision process, or if perhaps both need revision, but do indicate a need for further research into the understanding of how householders make decisions as consumers of energy.

The qualitative research used purposive and convenience sampling for recruiting the focus group members. At least two focus groups were attempted in each community: one was with the members of the community groups supporting the energy company’s efforts, and the other was with local household members who had answered the self-completion questionnaire and indicated they would be willing to take part in further research. Focus group guides were created, which consisted of between nine and eleven questions, and guided the discussions, which averaged to 45 minutes in length. Digital recordings were transcribed and statements were identified via content analysis which was iteratively grouped into models, but primarily statements were used as a way to complement, or contextualise, the quantitative findings. These results were not meant to be representative of the communities, but were meant to create a deeper understanding of the social environment.

The findings from the questionnaires and focus groups were used to address each hypothesis. Chapter 8 explains how each hypothesis was tested, and explains the findings, which are summarised in Table 8-47.

The findings have generally indicated that seeking information from personal contacts is an important aspect to the diffusion of energy-reducing innovations. This was demonstrated in the associations between occurrences of information-seeking and adoption of various technical and behavioural innovations (Hypothesis 5), which are discussed further below. The extent of the importance was not fully measured here, nor was a comparison made with information-seeking amongst non-interpersonal sources. However, the findings are an initial and important indication that information dissemination often occurs through interpersonal networks. This was not unanticipated, considering the common belief and evidence that diffusion occurs through ‘word of mouth’ (Arndt 1967; Johnson Brown & Reingen 1987); however, the research here was novel in operationalising and measuring this process with energy efficiency innovations in the UK.

The findings specifically indicate that respondents from the case study communities report they would be just as likely to ask someone they know about an innovation in the first instance of information-seeking as to consult media sources or approach organisations, confirming Hypothesis 1. In North Leigh and St Athan, the indications of potential information-seeking from the three indicated sources were evenly distributed: one-third indicated they would seek information on energy efficiency from people they knew; one-third indicated media sources, such as television and newspapers; and one-third indicated they would approach organisations, such as local councils or energy efficiency advice centres. In Alyth, responses were not as evenly distributed, with fewer respondents indicating they would check media sources, and proportionately more people indicating they would ask people they knew or approach organisations. Notwithstanding the caution of conflating intended actions with actual behaviour and the limitations on external validity for case studies, these findings have important ramifications for methods of information dissemination. Based on these findings and the literature in this field (Darley & Beniger 1981; Stern 2002), it is expected that fostering information and advice dissemination through interpersonal social networks in communities across the country could assist in increasing rates of adoption of these innovations. Further, the Energy Efficiency Resource Generator findings indicated that between 45% and 58% of residents reported they had access to at least one information resource, out of a possible twelve. The quantitative findings also show that between 41% and 55% indicated speaking to at least one person for the purpose of gaining information across all energy-reducing innovations. Very generally, this indicates that not only did around half of the respondents think they knew at least one person to approach for energy efficiency-related advice, but approximately half actually *did* contact at least one person. Accordingly, a policy recommendation emerges regarding the provision of support for increasing the utilisation of established social networks, e.g. local environmental or climate change groups, to disseminate energy efficiency information. Currently, emphasis is largely placed on providing information to a large audience via media sources such as the Government-supported *Act on CO_2* website and through organisations such as the Energy Saving Trust (Wallace et al. 2010). The *Act on CO_2* website calculates a carbon footprint and makes recommendations to users based on their lifestyle indications. The EST provides information and advice in a number of ways: they maintain a website (which is linked to the *Act on CO_2* website) with information, which includes a Home Energy Check questionnaire that offers recommendations and financial saving indications; they have leaflets and other publications, such as best practice guides; they have a free telephone number which people can contact; they provide advice through local level

through advice centres (Wallace et al 2010). These resources are important for information-seekers on energy efficiency (Wallace et al. 2010) but might be supplemented through mobilisation of existing social networks, which are often considered more accessible to householders and require less effort for information-seeking (van Rijnsoever & Castaldi 2008). Potential adopters may also have a certain degree of trust in established social networks such as friends (Stern 1986), particularly if the social network members appear to be motivated more by altruism than by benefits of financial gain, for example. Further, though informational influence and everyday habits are important, it is also possible that normative influence from peers may help explain adoption patterns (Midden & Ritsema 1983; Cialdini 2005). Similarly, understanding what peers think and do regarding household energy use is a means of evaluating, and possibly changing, a householder's own behaviour by social comparison (Van Raaij & Verhallen 1983).

One method for facilitating a social network approach is through the use of intermediaries (Moss et al. 2009; Backhaus 2010). "Intermediaries are organizations, individuals, and members of professional reference groups who stand somewhere between the originators of energy-related goods, services, and information and the ultimate energy users" (Stern & Aronson (eds) 1984, p.117). The advantage of an intermediary is the ability to act as a mediator between stakeholders, maintain a flexible structure, utilise established links or connections with end-users, build trust, and "support and facilitate learning processes" (Backhaus 2010, p.88). Intermediaries embedded in established networks can also act as opinion leaders (Weenig 1993; Rogers 2003) and change agents (Rogers 2003). The literature on intermediaries often refers to organisations which sit between energy providers, energy users, and energy regulators (Backhaus 2010), but they could also be community groups which are embedded in the target population, as they were in the case study communities here. The qualitative research conducted here, though limited in its generalisability, appears to indicate that those respondents who indicated seeking information within their local area appeared to trust the advice received from local intermediaries, i.e. the formally or informally trained individuals assigned the task of approaching fellow residents and spreading information. The groups in each community agreed to work with the energy company conducting the interventions in order to achieve the community-wide goal, and thereby uniquely sat between the people and aims of the energy company, and the householders within their local community. In North Leigh, the 'Challenge North Leigh' group evolved from a former group, and was mostly comprised of North Leigh community members, thereby utilising established, local social networks. The group was initiated by one opinion leader, in particular, and this opinion leader - along with

the other efforts of other members and the events organised by 'Challenge North Leigh' - appeared to have a big impact on raising awareness. In addition, North Leigh had an employee from the energy company who was based in the local library and available to offer information, which the local group indicated was particularly useful as that person brought a degree of authority and expertise which they did not have. The town of Alyth also had a local group – 'Alyth Climate Action Town' (ACAT) – which focused on climate change and had grown from a long-established, broader environmental group. A parallel initiative to the energy company's intervention - a 'street-by-street' campaign promoting insulation - meant that there were several local people working under a similar umbrella (ACAT) who were trained to approach householders and offer information to Alyth residents. In contrast, the 'Get Smart' group in St Athan was established only a few months before the intervention began. The relatively low awareness of the activities of the 'Get Smart with St Athan' group from the quantitative findings appears to indicate that the messages and purpose of the group had not diffused through the community as quickly as in North Leigh and Alyth. It could be that there is a necessity for a degree of longevity in the social networks and campaigns before they are noticed and regarded.

It is understandable that there are large resource issues with a social network approach and the use of intermediaries; ensuring that there are physically-present people to offer new information at the community-level requires many person-hours, funding, perhaps physical space, and various forms of support (Darby 2003). Another necessity for these groups, as emerged in the focus groups, would be positive feedback from the two (or more) groups which they are mediating, as morale is an important element of maintaining enthusiasm. Drawbacks of using 'intermediaries' might include: consistency of message cannot be controlled in the same way; contact with householders cannot be guaranteed; information might be contradicted by other sources or through rumours (Weenig & Midden 1991); and information providers have individual personal traits and priorities which may influence the manner in which a message is communicated. However, these are also issues that could be encountered with 'objective' *non*-interpersonal information provision. Information received from interpersonal contacts is likely to be more influential, and thus create more motivation. As Darley (1978) indicates, "persuasion seems to be most effective when is between individuals than when it is between an individual and an audience" (p.342) such as mass marketing campaigns.

However, the influence of intermediaries in spreading information on energy-reducing innovations as noted above, particularly in North Leigh and Alyth, does not appear to

be reflected in the findings of Hypothesis 2 and Hypothesis 5a. Hypothesis 2 (H2) speculates that householders will report more accessible 'energy social capital' and Hypothesis 5a (H5a) hypothesises that respondents will mobilise 'energy social capital' within their own geographic area. The quantitative results, based on a dichotomous boundary of 'within the community' and 'not within the community,' demonstrate that the majority of respondents did not consider seeking the majority of information from people within their own community (H2). There were also no significant associations, as per the chi-square tests, between actually seeking information from people within the community and adoption of energy-reducing innovations (H5a). The findings are consistent with indications in the literature that social networks are *not* geographically bound (Wellman & Wortley 2001), and that "...diffusion proceeds along sociometric rather than spatial networks" (Darley 1978, p.342) regarding energy conservation. However, the findings do not seem to parallel with the importance of the intermediaries as inferred above. Regarding H2, however, there is doubt in the validity of the findings, as it was suspected that information available from the other people in a respondents' own household was under-reported. Regardless, the number of members in the community groups (i.e. intermediaries) was quite low, so it is unlikely that very many respondents under-reported 'intermediaries' within their own home. Therefore, it seems a paradox that respondents reported gaining most of their information from social network members who lived *outside* of the community in relation to adoption, but the local community groups seemed to make a positive difference of information diffusion by interacting with local householders. Looking at the raw data for mobilised 'energy social capital' here (H5a), however, does indicate that fairly approximate numbers sought information from people in the same community, and from outside the community, in North Leigh and St Athan (i.e. across each alter approached, around half indicated approaching people within the community). And in Alyth, respondents *always* indicated speaking to more people *within* the community. Therefore, it seems that – at least in Alyth – more respondents did indicate speaking to people within the community, even if it was unrelated to adoption of innovations according to the chi-square tests of significance. It could be the case that before the interventions occurred, people did not seek information on energy efficiency from other people in the same community at all. Indeed, in one study on thermostats in the United States in which respondents (labelled 'innovators') were asked to refer their friends for the research study, *none* of the referees (i.e. 0%) came from within the neighbourhood (Darley 1978). If this were the case for the communities in this research before the interventions, the change in seeking information for energy-reducing innovations 0% of the time before the intervention, for example, from within the same community to approximately 50% (or more, as in Alyth) after the intervention would seem like a large

increase. These are speculations, and cannot be validated due to the cross-sectional nature of the research design, but in future it would be very useful to examine the use of social networks within a geographic location both before and after an intervention. If findings indicated that householders sought information from within the community about half the time after an interventions, and this was much more than 'normal', than this would lead the researcher to believe that the intermediaries were quite effective in information diffusion at the community-level. This would then lend further support to the efficacy of community-level, intermediary-supported interventions.

In Hypothesis 3 (H3) and Hypothesis 5b (H5b), another dichotomous relationship of information-seeking was examined: strong versus weak ties. Much has been written about the propensity for information diffusion and information-seeking through strong ties (e.g. friends and family) and weak ties (e.g. acquaintances) in both the diffusion of innovation literature and the social network and social capital literature (Granovetter 1973; Lin 2001b; Rogers 2003). There are indications that the 'strength of weak ties' is important for diffusion (Granovetter 1973), due to the fact that better information and resources are often beyond the immediate reach of the person seeking the resource; the resources readily available through close, intimate ties are already known to the person, and therefore not as useful. However, it has also been argued that it largely depends on the resource and reason it is sought as to whether the 'strength of weak tie' will be appropriate. Rogers (2003), for example, argues that though weak ties may be important for spreading information, strong ties are more important for their level of influence upon the information-seeker. Thus, H3 hypothesises that respondents would seek information from weak ties, as the potential for information (accessible 'energy social capital') does not need to be limited to sources of influence. H5b, however, focuses on mobilised 'energy social capital' which has already been sought, and therefore may be more related to influence of alters; it was hypothesised that strong ties would be associated with adoption of energy-reducing innovations. The findings indicate that H3 was confirmed for North Leigh and Alyth, and rejected for St Athan. There was a significant preference in North Leigh and Alyth, according to binomial tests across a number of variables in the Energy Efficiency Resource Generator, in seeking information from weak ties, defined as neighbours, others in the community, acquaintances and colleagues. And in St Athan, there was always a preference for seeking information from strong ties, defined as family and friends. These findings compared with the findings for mobilised 'energy social capital' and adoption. Even though the Fisher's Exact tests for H5b were actually not significant for any of the communities (i.e. there were no significant relationships between adoption of energy-reducing innovations in any category and mobilisation of 'energy social capital'

according to the strength of tie), the raw data indicates that information-seeking amongst strong or weak ties varied depending on the innovation. In both North Leigh and Alyth, respondents indicated they were more likely to seek information from weak ties for the innovation category Visual (and in North Leigh, also for the innovation category WWDF). The broad implications are that householders cannot be expected to seek information in the same way for all innovations, or from the same people. Newer innovations are likely to cause a degree of confusion or uncertainty for potential adopters; the social contacts whom those householders approach will need to be able to assuage any fears or concerns with a degree of authority. If those social contacts happen to be local community group members, for example, it would be necessary for those 'intermediaries' to be able to listen and help to address those concerns, e.g. via information provision, demonstrations, and assurances.

It is again worth noting, however, that St Athan respondents differed in that they always indicated approaching strong ties for information. These findings indicate a rather striking difference between St Athan and the other two communities, particularly in the adoption of Visual displays, as it thus cannot be assumed that St Athan residents would look to intermediaries for advice. The dissimilarities between communities are not explained by the qualitative data. It is speculated that one reason for the discrepancy could be that the close contacts of respondents in St Athan act as 'sub-intermediaries' between information sources, such as local community groups (i.e. intermediaries) or other (non-)interpersonal sources, before it is trusted. If this were the case, information might need time to 'trickle down' through local social networks. Perhaps respondents in North Leigh and Alyth were more amenable to searching for information amongst weak ties as the established networks had already had time to 'trickle down' similar messages in the past.

Another reason for the discrepancy between communities could be related to the other measured variables in which St Athan was found to be quite different from North Leigh and Alyth. St Athan respondents were comparatively less satisfied with their community, had proportionately fewer people with an education of degree level or above, were not as aware o the local energy initiative and had discussed it less, and knew of fewer people to approach for energy-related information. It appears that these issues, in particular, may be interrelated, as per a National Statistics report which is based on the 2000/2001 General Household Survey of UK households (Haezewindt 2003):

> "People with qualifications were more likely than people without qualifications to be better informed about their local area and more likely to be involved in a

> local organisation. Despite knowing and speaking to fewer neighbours, people with qualifications were more likely to be trusting of their neighbours and more likely to do and receive favours from neighbours. ... Those with qualifications were more likely to have a better perception of their local neighbourhood ..." (p.22-23, emphasis added).

These corresponding variables, and particularly the reported qualification levels, thus may help explain why respondents in St Athan do not appear to be seeking information from people within the community (H2) as well as why they prefer to speak to only family and friends for advice (H3).

Finally, it could be that there are simply exogenous variables which were not measured here that could explain the differences between communities. For example, as Darley & Beniger (1981) indicate in their discussion of social networks and the diffusion of energy innovations, "the nature of kinship ties is likely to be a cultural determinant" (p.164). Perhaps there are social norms of kinship, or other cultural differences between the UK countries, which contribute to the varying findings in St Athan. Further research which gathers more variables might be able to explain these differences in more depth.

The findings for H3 and H5a also suggest that energy efficiency intervention programmes should be wary of applying 'blanket' approaches on the community-level; what may work in one community, may not work in another. A pre-evaluation tool would assist those preparing interventions to understand the most effective and targeted approaches for a particular community. The Energy Efficiency Resource Generator could act as part of such a pre-evaluation tool. As implementation via self-completion questionnaires was here proved as a reliable method, a similar short survey of a community would assist programme developers in tailoring the organisation and application of an intervention programme in a given area. It would also be useful to pair this with a 'general social capital' resource generator (Webber & Huxley 2007) to assess broader resources available amongst interpersonal contacts. The findings could help to create realistic expectations, as it may be that certain communities will not achieve the same levels of interaction or goals of energy reduction as other communities. Those results could be important, and also indicate that comparison between communities is not always appropriate, particularly if they are dissimilar in fundamental ways.

Strong ties are often considered to encompass a degree of homophily (Johnson 2004; Lin 2001b), or the tendency to contact and be friends with people 'like me'. Hypothesis 5c (H5c) sought to understand the association between homophily and adoption of

energy-reducing innovations. Homophily was measured for both the respondents and the named alters with whom they spoke across four variables (gender, education, marital/partner status, education level) which were combined into one scale variable. This scale variable was compared to another created scale variable measuring adoption. The conclusions indicated that there were almost no significant relationships, except one instance North Leigh where it appears that a lower homophily (i.e. greater levels of dissimilarity) was associated with adoption of energy-reducing innovations. Though there were few significant results from the Spearman's test, it is uncertain that the null hypothesis (i.e. that reported adoptions are *not* associated with the mobilisation of 'energy social capital, particularly with homophilous ties) should be accepted. This is because the data collection method separated the homophily variables from innovation categories, in order to avoid a lengthy questionnaire, but means that a level of specificity is missing. There are not many conclusions which can be drawn from these results, and qualitative data was limited. It is suggested that future studies should be careful in the instrument design in measuring homophily, and perhaps consider other variables in addition to the four identified here to include building demographic and household composition information, as these are often linked to energy efficiency adoptions in the literature (Wright 2008; Shipworth 2010). However, perhaps the focus on strength of ties should be a priority; given the theoretical link between the two concepts, perhaps the results of strength of tie studies could act as a proxy for homophily, which may be a difficult concept to quickly measure with a fine degree of specificity.

Hypothesis 5d (H5d) examined the relationship between the number of people from whom respondents sought information and adoption of energy-reducing innovations. The findings of the logistic regressions indicate that respondents were more likely to adopt Visual innovations, e.g. smart meters and current cost monitors, in North Leigh and St Athan with every extra person they approached. In Alyth, the findings were similar, but for different innovations; respondents were more likely to adopt WWDF and Behave innovations as they spoke to more people. These findings have implications for the operations of future programmes. For example, if intermediaries are trained to deliver energy efficiency advice, and incorporate referrals to speak with other people, this could help to increase adoption rates, perhaps due to the fact that potential adopters seek to reduce uncertainties and alleviate perceived complexity. Recommendations can reinforce messages, allowing potential adopters to 'trial by others', e.g. observing how other people interact with, or think about, their smart meter. There are certain assumptions, here, however; the advice would likely need to be in favour of installing or implementing the energy-reducing innovation. Hypothesis 5e

(H5e) addressed the issue of positive advice. The raw data indicated that most respondents reported receiving positive advice. Further, significant chi-square tests indicated there was a relationship between receiving positive information on Visual innovations and adoption of those innovations. Therefore, with each person respondents speak to who are positive about the innovation, and assuming the information does not conflict with previous advice, it appears that they would be more likely to move from 'awareness' to 'persuasion' and 'decision' in the innovation-decision process, consistent with the literature (Rogers 2003; Bartiaux 2008).

The need for consistent advice was an issue raised in the qualitative findings in Alyth. It appears that householders were confused when they received contradictory advice from the local intermediaries and contractors installing insulation. Though it is difficult to ensure consistent and positive advice, it is also difficult for householders to understand conflicting information, particularly if it comes from multiple sources, all of which carry a certain amount of authority. It is perhaps at this point when provision of 'objective' information in the form of information leaflets, websites, or best practice could enhance the 'word of mouth' advice. It would thus be useful for intermediaries to have access to more specific information, when it is needed by householders, either from professional organisations or trusted online sources.

The findings which indicated variations in adoption and mobilisation of 'energy social capital' by innovation type were further reflected in Hypothesis 5, which was the overarching hypothesis that stated: *The reported adoption of energy-reducing innovations will be associated with the mobilisation of 'energy social capital'.* The findings from chi-square tests and from investigation of the raw data indicated that this hypothesis appeared to be true for some innovations, but not for others. The innovation categories of 'walls, windows, doors & floors' (for North Leigh and Alyth) and particularly Visual displays (for all three communities) were significantly associated with the mobilisation of energy social capital. WWDF and the smart meters in the Visual category require relatively firm decision by householders, as the installation of insulation and electricity meters are not innovations which are easily reversible. The implication of H5 is that householders will use their social networks to seek advice, at least to a certain degree, which in turn is associated with making decisions regarding, and adopting, these innovations. Conversely, it also appears that information on Behave innovations and AHL innovations are not associated with mobilised energy social capital. These innovations were largely adopted in each community *without* respondents indicating they had spoken to anyone. Overall, the results indicate that different information resources are associated with adoption of different innovations. As

certain innovations are performed more regularly, including daily actions (i.e. turning on lights and electrical equipment) and more regular maintenance (i.e. replacing light bulbs), perhaps people do not feel the need for more information, or avoid seeking information which would conflict with their current attitudes or actions, and thus cause cognitive dissonance. It was often strong advice which was sought for Behave and AHL innovations, as well, the implication being that if information *is* sought from personal networks, it may be with people in the same household. Equally, this means that people seeking information on insulation and draught-proofing (i.e. WWDF innovations) and smart meters (i.e. Visual innovations) may be more likely to seek information from social networks outside the home. An inference is that organisations or groups conducting and / or facilitating energy efficiency interventions (e.g. energy companies and local community groups) may need to be prepared to offer more - e.g. more in depth or more technical - information on newer or less understood innovations, particularly those which may involve a large cost and are limited in their reversibility, in a way which is easily accessible and understandable for the householder.

To summarise the research presented here, using social networks for information-seeking has been theorised in the literature to influence adoption of household energy efficiency behaviours and technologies (Darley & Beniger 1981; Coltrane et al. 1986). There are a few empirical examples of this type of research in other countries (Weenig & Midden 1991; Weenig 1993; Ball et al. 1999), but this line of investigation is rare and had not been pursued in the United Kingdom. Using three UK communities as case studies and employing a mixed methods approached involving a self-completion questionnaire and focus groups, the results indicate that individual-level 'energy social capital' is important when it comes to seeking information on energy-reducing innovations. Stated more simply, 'word of mouth' is as important as information from websites or professional organisations for householders who are considering energy efficiency and energy conservations measures in their homes. Many factors including 'energy social capital' influence householders' decisions to adopt energy-reducing innovations. The relative importance of 'energy social capital' varies by the type of innovation and location. Respondents were more likely to seek information on WWDF and Visual innovations. This may be because these are two categories that perhaps have greater uncertainty surrounding them and can require big decisions on the part of the householder. For directed interventions, such as those trialled here, the use of established local community groups trained in the provision of advice and information on home energy use is an important method of information diffusion. These 'intermediaries' stood between the energy company and the householders, making information accessible to householders through interpersonal contact.

Key recommendations from these research findings are:

- Variations between innovations and communities mean that 'blanket' approaches and policies will not be as effective as those which are tailored to individual UK villages and towns.
- Tailoring approaches to specific innovations and communities can be guided by conducting a pre-assessment of communities employing the Energy Efficiency Resource Generator developed in this thesis. This will allow assessment of the amount of information householders feel they have at their disposal, and also the preferences for information-seeking amongst people they know, be they strong or weak ties, or within or outside of the community.
- Those conducting or assisting interventions should have practical expectations, as it is unlikely that there will be similar results amongst dissimilar communities.
- Intermediaries should encourage householders to ask others who have already adopted, or have had similar experiences, as it was shown that speaking to more people about energy efficiency was correlated with higher adoption rates for certain innovations.
- Personal referrals, along with 'objective', non-interpersonal supporting information, may also help to reduce any confusion, especially if householders receive conflicting advice.

The establishment of 'intermediary' networks in other contexts is likely to take considerable effort, and this is not underestimated. However, the necessity for tackling home energy use in existing homes in the UK is great, and the policy goals are ambitious. The solutions are not going to be easy 'fixes', nor is there likely to be any single solution, but this research has shown the importance of information-seeking from interpersonal contacts in the context of household energy use, adding to the existing theoretical and empirical evidence and ultimately contributing to helping the UK achieve its energy reduction goals.

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Volume 2

APPENDICES TO

SOCIAL CAPITAL AND THE DIFFUSION OF ENERGY-REDUCING INNOVATIONS IN UK HOUSEHOLDS

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Table of Contents (Appendices)

Appendix A. SUMMARY OF POLICIES RELATING TO ENERGY EFFICIENCY IN EXISTING HOUSING

Appendix Table 1 provides a summary of UK policies which are relevant to energy efficiency and energy conservation in existing housing, in addition to the policy concerns which are largely addressed in each document.

Appendix Table 1: Summary of policies relating to energy efficiency in existing housing and the policy concerns addressed

Policy document & date	Aims & Provisions	Policy concerns		
		Energy security	Climate change	Fuel poverty
Changes to Part L of the Building Regulations (2000), particularly L1B: Conservation of fuel & power in existing dwellings Effective from: 1 Oct 2010	Aim: Address energy efficiency in housing regulations. Provisions: The main emphasis of Part L regulations is to require a 25% energy efficiency improvement in new build, as compared to 2006 regulations (HM Government 2010). For existing buildings, measures will apply to extensions, conversions, renovations, replacement of windows and boilers		✓	
Energy Act 2010 Received Royal assent on: 8 April 2010	Aim: It implements some of the key measures required to deliver DECC's low carbon agenda as set out in the Low Carbon Transition Plan (DECC 2009b). Provisions: Makes provisions for carbon capture, fairness for energy markets and measures relating to Ofgem, and with regard to household energy, it increases the amount energy companies can spend on social support (mandatory social price support), particularly targeting those in fuel poverty.	✓	✓	✓
Warm Homes, Greener Homes Strategy Announced on: 2 March 2010	Aim: The ultimate aim is to reach goals of Low Carbon Transition Plan of 29% reduction in carbon emissions from the household sector. Policies to date provided measures to achieve 20 MtCO2e reduction from the household sector, but this is 4 MtCO2e short of the 29% reduction target as set out in the Low Carbon Transition Plan. This Strategy addresses that extra 4 MtCO2e. Provisions: The 4MtCO2e will be met through "complete the installation of cavity wall and loft insulation for every home where practical to do so by 2015" which is 0.5 MtCO2e, and installing eco-upgrades, the other 3.5 MtCO2e, "which go beyond standard insulation measures to include solid wall insulation and/or micro-renewable energy generation – in up to 7 million homes by 2020. To achieve this in practice, we project that our capacity to deliver more significant insulation will need to develop fast, getting close to its steady state around or shortly after 2015." (DCLG & DECC 2010, p.12). It also addresses the period after the end of CERT in 2012 with new energy company obligations, and enables 'pay as you save' scheme for the eco-upgrades. Further, it addresses community partnerships, new standards for the rented sector (including Warm Homes), and support for consumers. The strategy encourages local authorities to be responsible for energy savings in their area.	✓	✓	✓
The Electricity and Gas (Community Energy Saving Programme) Order	Aim: "The Community Energy Saving Programme 2009-2012 (CESP) is a policy instrument for improving energy efficiency standards across Great Britain in given geographical areas" (Ofgem 2009a, context page) with greater concentrations of low-income households.		✓	✓

Policy document & date	Aims & Provisions	Policy concerns		
		Energy security	Climate change	Fuel poverty
2009 Came into force on 1 September 2009	Provisions: "The Order requires energy suppliers and for the first time electricity generators to comply with an overall carbon emissions reduction target of 19.25 million tonnes of carbon dioxide (MtCO2). Obligated suppliers and generators must perform their obligations between 1 October 2009 and 31 December 2012."[201]			
Low Carbon Transition Plan (White Paper) Announced on: July 2009	Aim: "The plan to 2020 will cut emissions from homes by 29% on 2008 levels, introduce further measures to protect the most vulnerable, and improve the security of our gas supplies, a third of which is used in our homes." (DECC 2009b, p.10) The Plan meets the requirements of sections 12 & 14 of Climate Change Act 2008. Provisions: Increases CERT – investing more money in CERT to increase it by 20% (so that £0.6B more will be invested, bringing total to £3.2B) between April 2008 and March 2011, and also extends it until the end of 2012. Increasing savings expected from 154 to 185 million tonnes of CO2 saved. Establishes plans to roll out smart meters to every home by 2020. Aims to develop "more proactive services from the Energy Saving Trust to provide households with information and advice at the right times." (DECC 2009b, p.79). Other provisions include piloting a pay as you save scheme, implement a Community Energy Saving Programme, and other provisions for generating renewable energy or being 'green'. Also aims to assist communities work together by: "1) Announcing £10m for 'Green villages, towns and cities', a challenge for communities to be at the forefront of pioneering green initiatives, with 15 or so 'test hub' areas. 2) Developing an online 'How to' guide for anyone looking to install renewable and low-carbon energy generating technologies at community scale. 3) Exploring how to unlock greater action by local authorities in identifying the best potential for low carbon community scale solutions in their areas." (DECC 2009b, p.79) The measures will increase bills by 6% (total of 8% if include other policies), so aim to address fuel poverty as well.	✓	✓	✓
Climate Change Act 2008 Received Royal assent on: 26 November 2008	Aim: The Government aims to improvement carbon management and demonstrate international leadership on climate change with this Act. Provisions: Provisions include, but are not limited to, setting intermediary carbon dioxide budgets to meet 80% reduction in CO2 emissions by 2050 (and 34% by 2020) on 1990 levels. Created the Committee on Climate Change (CCC), an expert group to advise the Government on carbon budgets and offer guidance. It will also offer powers to support creation of the Community Energy Savings Programme which extends the Carbon Emissions Reduction Target to electricity generators (*Climate Change Act* 2008).	✓	✓	✓
Energy Act 2008 Received Royal assent on: 26 November 2008	Aim: Updates legislation to reflect changes in technologies, particularly with carbon capture and storage and renewable energy source technologies. The Energy Act 2008 implements the legislative aspects of the Energy white paper 2007: 'Meeting the energy challenge'. Provisions: Broader provisions address offshore gas supply infrastructure, carbon capture and storage regulations, the Renewables Obligation, decommissioning of offshore energy projects, improving licensing, nuclear energy issues, and offshore transmission. The provisions that effect existing household energy consumption including the provision of feed-in tariffs, modifying licenses to enable smart metering to move forward, and a Renewable Heat Incentive to support heat generation (*Energy Act* 2008).	✓	✓	✓

[201] Ofgem, http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/cesp/Pages/cesp.asp

Policy document & date	Aims & Provisions	Policy concerns		
		Energy security	Climate change	Fuel poverty
Home Energy Saving Programme September 2008	Aim: Increasing public and private investment in household energy efficiency, particularly in light of increased fuel bills. Provisions: This £1bn package of measures and proposals included increasing the savings from CERT by 20% (from 154m lifetime tonnes of CO2 to 185m tonnes), boosting supplier investment over the three year period; a new £350m Community Energy Saving Programme (CESP), targeting low-income households by improving energy efficiency standards and reducing energy bills; more funding (£74m) for Warm Front; increase in marketing the Act on CO2 brand; an increase in Winter Fuel Payments; announcing plans to develop the Heat and Energy Saving Strategy.		✓	✓
Carbon Emissions Reduction Target Effective from: 1 April 2008	Aim: Energy supplier obligation that must deliver measures to achieve 185MtCO2 lifetime savings between 1 April 2008 and 31 March 2011, with possible extension. (This was originally set at 154MtCO2, but was increased by 29% to 185MtCO2 following a consultation and as set out in the Home Energy Saving Programme.) Provision: Energy supplier obligation that must have 40% focus on 'Priority Groups' of vulnerable and low-income households. Suppliers are required to report to Ofgem regarding the Priority and non-Priority groups on the measures of "insulation, lighting, heating, appliances, micro-generation & CHP and demonstration action."[202]		✓	✓
Energy white paper 2007: 'Meeting the energy challenge' Published on: 23 May 2007	Aim: This white paper set out the Government's national and international strategy to achieve policy goals of energy security, emissions reductions, fuel poverty and promoting competitive energy markets. Provisions: Many provisions are set out regarding many facets of energy provision and energy use. With regard to household energy use, the White Paper indicated that the Government would increase information made available to householders, particularly on carbon emissions via the campaign 'Act on CO2'; require Energy Performance Certificates for homes and buildings; establish the Carbon Emission Reduction Target, to take over after EEC2; improve billing; trial smart metering, particularly through the Energy Demand Reduction Project (DTI 2007). This White Paper was a response to the 2006 Energy Review.	✓	✓	✓
UK Energy Efficiency Action Plan 2007 Required by European Commission on or before: 30 June 2007	Aim: To provide policies and measures in order to "contribute to the achievement of our climate and energy policy objectives and to meet the 9% energy saving target by 2016 under the European Union's Energy End-Use Efficiency and Energy Services Directive. We expect to exceed the 9% target, delivering 272.7 TWh in savings by the end of 2016, equivalent to a saving of 18% over the target period." (Defra 2007a, p.6). Provisions: Highlights what has been done in other policy areas, namely the successes achieved, and the implementation of the Carbon Emissions Reduction Target; revisions to Part L of the Building Regulations to achieve zero-carbon new build homes by 2016, with help from the Code for Sustainable Homes; continued support for Warm Front and Decent Homes; provision of Energy Performance Certificates in homes; and support for energy efficient product development through the Market Transformation Programme.		✓	✓
Code for Sustainable Homes 13 December 2006	Aim: To set a new national standard for the design and construction of new homes, above the requirements of Building Regulations, for not only energy, but waste, materials and ecology.		✓	

[202] Ofgem, http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/CU/Pages/CU.aspx

Policy document & date	Aims & Provisions	Policy concerns		
		Energy security	Climate change	Fuel poverty
	Provision: "The Code provides a single national standard to guide industry in the design and construction of sustainable homes, considering not just energy but also water, materials, waste and ecology" (Defra 2007a, p.23). "The Code is intended to signal the future direction of Building Regulations in relation to home carbon emissions from and energy use, providing greater regulatory certainty for the homebuilding industry. The Code uses a 1 to 6 star rating system to show the overall sustainability performance of a new home."[203]			
Energy Review 2006 Published: 11 July 2006	Aim: To position the UK to meet the long-term challenges of climate change and energy security. Provisions: Proposals were made for, *inter alia*, the successor programme to EEC2, energy billing and metering, all of which were consulted on and recommendations made for the Energy White Paper 2007.	✓	✓	✓
Amendment to Part L of the Building Regulations Effective from: 6 April 2006	Aim: Updated and replaced 2002 edition of the Building Regulations Provisions: New energy performance requirements were established, and amendments made to the Building Regulations 2000. The performance standards that were changed involved thermal elements, windows, doors, heating, hot water, ventilation & lighting (ODPM 2006). Energy efficiency and performance measures only apply to existing housing where building works or extensions take place.		✓	
Climate Change and Sustainable Energy Act 2006 Received Royal assent on: 21 June 2006	Aim: Aims including meeting the requirements as established in the Housing Act 2004, namely reporting on energy efficiency improvements with the aim of 20% in the household sector by 2010 on 2000 levels. Provision: Allows the Government to expand the range of measures that can be used by energy suppliers to deliver their commitments under EEC" (DTI 2007, p.58)		✓	✓
Climate Change: The UK Programme 2006 March 2006	Aim: Meet the challenges of climate change Provisions: In the household sector, this Programme indicates provision to "contribute an additional 1.2 MtC of carbon savings 2010", adding to what the Climate Change Programme 2000 already set out, "bringing total savings in 2010 to 4.8 MtC" (Defra 2006, p.74). This would be done through enhanced Building Regulations in 2006; higher savings through Energy Efficiency Commitment in 2008-2001; Code for Sustainable Homes; more energy efficient products; energy consumption feedback through billing and metering; continuing with Warm Front and Decent Homes programmes; supporting communications through Energy Saving Trust and Climate Change Communication programme.	✓	✓	✓
Energy Efficiency Commitment 2 Effective: 1 April 2005 – 31 March 2008	Aim: Reduce energy consumption in the household sector by 130TWh between 1 April 2005 and 31 March 2008. Provisions: A minimum of 50% of the target population needed to be within a Priority Group of consumers, which meant those receiving tax credits or benefits relating to income			✓
Energy Efficiency: The Government's Plan for Action April 2004	Aim: To set out how the Government will meet its targets as set out in the Energy White Paper 2003, particularly for the period 2004-2010. Same aims as other documents of maintaining energy security, tackling climate change, addressing fuel poverty and maintaining competitive markets.	✓	✓	✓

[203] Energy Saving Trust website, http://www.energysavingtrust.org.uk/business/Business/Housing-professionals/New-housing/The-Code-for-Sustainable-Homes

Policy document & date	Aims & Provisions	Policy concerns		
		Energy security	Climate change	Fuel poverty
	Provisions: For households, the document announced an aim to save 4.2M tonnes of carbon from households by 2010, with 3.5M tonnes from homes in England alone (Defra 2004). This aim was a requirement of the Sustainable Energy Act 2003. Aimed to double the savings of EEC in the next phase (EEC2). Set fiscal incentives, particularly for private sector landlords.			
Housing Act 2004 Received Royal assent on: 18 November 2004	Aim: Wide ranging document to address vulnerable households and also to help the Government achieve its 2010 Decent Homes target. Provisions: Regarding household energy use, a target was set "which requires the Secretary of State to take reasonable steps to improve residential energy efficiency in England by at least 20 per cent by 2010 from a year 2000 baseline." (Defra 2007a, p.20)		✓	✓
Energy Act 2004 Received Royal assent on: 22 July 2004	Aim: To implement provisions in the Energy White Paper 2003. Provisions: Regarding household energy use, the Act altered the Sustainable Energy Act 2003 to require reporting on household energy efficiency aims (*Energy Act* 2004).	✓	✓	
Energy white paper 2003: 'Our energy future: creating a low-carbon economy' Published on: February 2003	Aim: To achieve a path towards 60% reduction of CO_2 by 2050 on 1990 levels; maintain secure energy supplies; promote competitive markets; improve productivity; address fuel poverty. Provisions: Addressed building regulations; the Energy Efficiency Commitment on suppliers; addressing fuel poverty. This was "the first comprehensive energy white paper since 1967" (Lovell et al. 2009, p.96).	✓	✓	✓
Sustainable Energy Act 2003 Received Royal Assent on: 30 October 2003	Aims: Make provisions about the development and promotion of a sustainable energy policy and to amend the Utilities Act 2000 Provisions: This Act "required the Government to publish a statutory aim for residential energy efficiency in England" (Defra 2007a, p.19). It also instigated the implementation of the UK Energy Efficiency Action Plan 2004 and brought an end to the Home Energy Conservation Act 1995 requirements of reports from local authorities.	✓	✓	✓
Energy Efficiency Commitment 1 Effective: 1 April 2002 – 31 March 2005	Aim: Reduce energy consumption by 62 TWh during the period 1 April 2002 until 31 March 2005. Provisions: A minimum of 50% of the target population needed to be within a Priority Group of consumers, which meant those receiving income-related benefits (Ofgem 2005).			✓
Performance and Innovation Unit's Energy Review 2002	Aim: A review of the state of energy and environmental concerns to date. Provisions: Gave recommendations to the Government to provide incentives to different sectors to address important energy concerns; keep energy policy under review; and implement a "radical agenda" for widespread change over long-term periods (PIU 2002, p.55).	✓	✓	✓
Decent Homes Standard Established in 2001	Aim: Provide a minimum standard which social housing should meet. Provisions: With regard to energy, the Decent Homes standard indicates that all social housing must meet a minimum thermal comfort level by 2010.[204]		✓	✓
Climate Change Programme 2000 November 2000	Aim: To meet commitments under the 1992 United Nations Conference on Environment and Development, to meet Kyoto targets as well as national targets for 20% reduction in emissions by 2010. Provisions: For the household sector, the programme intended to	✓	✓	✓

[204] Department of Communities and Local Government, http://www.communities.gov.uk/publications/housing/decenthomescapturing

Policy document & date	Aims & Provisions	Policy concerns		
		Energy security	Climate change	Fuel poverty
	improve Building Regulations; put an Energy Efficiency Commitment requirement on energy suppliers (as per Utilities Act 2000); a New Home Energy Efficiency Scheme; an Affordable Warmth Programme; promote community heating; and promote more efficient heating, appliances and lighting. "The policy measures forming the backbone of the programme were the imposition of value added tax on domestic fuel and the establishment of the Energy Saving Trust" (Lovell et al. 2009, p.95).			
Utilities Act 2000 Received Royal assent on: 28 July 2000	Aim: Amended the Gas Act 1986 and Electricity Act 1989 and gave power to the "Secretary of State to set overall energy efficiency targets on suppliers" (Ofgem & EST 2003, p.41). Provisions: "The Utilities Act 2000 gave powers to the Secretary of State to set energy efficiency targets on suppliers" (Ofgem & EST 2003, summary page), which allowed the Energy Efficiency Commitment to replace the EESoP.	✓	✓	✓
The Home Energy Efficiency Scheme Regulations 1997 11 March 1997	Aim: Address fuel poverty Provisions: Provide grants for vulnerable householders (over 60, disabled, etc.). Updated the HEES 1990 to also include funding for cavity wall insulation, heating controls and other measures (Ekins et al. 2002)			✓
Home Energy Conservation Act 1995 Received Royal assent on: 28 June 1995	Aim: Think this requires local authorities to create Home Energy Conservation programmes and report back to central Government. Provisions: Called for a 30% reduction in household energy use by 2010, measured according to SAP ratings. Also addresses fuel poverty.		✓	✓
Energy Efficiency Standards of Performance (EESoP) Effective from: 1994 - 2002	Aim: Set targets for electricity suppliers in the early phases and then also gas suppliers in the later phases to increase energy efficiency and reduce fuel bills. Provisions: The scheme focused on disadvantaged customers and was managed by Ofgem (initially Offer) and the Energy Saving Trust[205]. This ran in three phases: 1994-1998; 1998-2000; 2000-2002.			✓
The Home Energy Efficiency Scheme 1990, as established by the Social Security Act 1990 (c.27) Effective from: Jan 01	Aim: Address fuel poverty Provisions: Provide grants for vulnerable householders (over 60, disabled, etc.). Provided grants for loft insulation and draught-proofing.			✓

[205] Ofgem, http://www.ofgem.gov.uk/Sustainability/Environment/EnergyEff/PrevSchemes/Pages/PrevSchemes.aspx

Appendix B. RESEARCH DESIGN OPTIONS

This appendix examines research design options in more depth, explaining each and the reasons why the type of design was, or was not, considered in the research conducted here.

An experimental design is one that actually manipulates the independent variable in order to test the effect on the dependent variable and is subject to random assignment (Bryman 2008). The classic experiment design, often referred to as the 'randomized experiment' or 'randomised controlled trial' (Bryman 2008, p.36) generally establishes two groups, a control group and an experimental group. The experimental group receives some form of manipulation and both are tested on the outcome, or dependent, variable. Experiments are generally regarded as very robust because they have strong internal validity.

There are several types of experimental designs including laboratory experiments, field experiments, and quasi-experiments. A laboratory experiment is "…conducted in a laboratory, where all external factors can be controlled" (Sarantakos 1993, p.243). In a laboratory experiment which involves people, the experimenter brings subjects in to a contrived environment and can manipulate the arrangements. Laboratory experiments suffer from a lack of external validity; the results from laboratory experiments cannot be guaranteed to be applicable in real-world settings given the false nature of the environment, which made it inappropriate for the research presented here.

A field experiment occurs in a real-world setting. They also generally consist of at least two groups, one of which is a control group and the other of which is manipulated in some way and uses random assignment. But as the experiment is in a real-world setting, it generally is said to have higher external validity, if properly designed. Very generally, these are usually conducted by either comparing two groups using, for example, a static group comparison design (Campbell & Riecken 2006), or by using some form of pre-testing and post-testing in the form of, for example, a pretest – posttest control droup design (Campbell & Riecken 2006). A field experiment would be a useful research design for testing the research questions, but with the research setting as presented, largely due to the fact that the experimental manipulations were being conducted by an external agency which was not following a specific research design. There was also no random assignment. Further, no control group was established, though this conceivably could have been selected from neighbouring

villages, controlling for certain socio-demographic variables. However, the factors weighing against this design ruled it out for the research proposed here.

A quasi-experiment is study that has certain characteristics of experimental designs but that do not fulfil all of the internal validity requirements. As Cook & Campbell (2006) explain:

> "As the name suggests, quasi-experimentation aspires to approximate the 'experimental method', usually in settings where 'full experimental control' is not possible because researchers are trying to identify the consequences of social changes in naturalistic contexts" (p.305-306).

Usually manipulation of experiment is not possible, and this research design does not always use random assignment. Replication in a variety of times & places is important for quasi-experimental designs (Campbell & Riecken 2006, p.288). This type of experiment could potentially be used to study the research questions, as the social setting is being altered, but there is no opportunity for random assignment. The internal validity would be quite weak, but there would be great confidence in the ecological validity, i.e. “the question of whether social scientific findings are applicable to people’s everyday, natural social settings” (Bryman 2008, p.33). The main limitation is the absence of comparison groups. The villages as presented in the research setting are located in different countries of the UK, and to compare them might be neglecting important cultural and other differences.

A cross-sectional design is one that measures variables from two different groups at a single point in time in order to compare those groups (de Vaus 2002a). Cross-sectional designs favour surveys in examining the variables which occur naturally, rather than those which are manipulation in an experiment (Selvin 2006). Cross-sectional design tends to lack internal validity because the causal link is often imprecise; data display associations more often than they produce causal findings. External validity can be quite high if random sampling is used, though becomes weak if non-random methods are used.

The research methods associated with cross-sectional design can be distinguished by the type of research strategy. Quantitative cross-sectional research designs usually employ methods of survey design, be they computer-assisted personal interviews or self-completion questionnaires. Qualitative cross-section research designs can employ methods of interviewing, whether unstructured or semi-structured, or focus groups. A cross-section design could be quite appropriate for the research as proposed here, as it involves more than one case, takes place at a single point in time, aims to determine

patterns of association, is potentially applicable for sampling logic, and has a unit of analysis relevant for survey design (Bryman 2008). However, in considering the multiple types of research designs, it was decided that the villages in the proposed research setting unique real-world contexts which may have been influential in the outcomes from any data. Community-level data may be an important determining factor in considering the influence of individual 'energy social capital' on the diffusion of energy-reducing innovations, particularly given the community-led element of the energy interventions. A cross-sectional design would focus on individual householders, missing the community level data.

A longitudinal design is in which "a sample is surveyed and is surveyed again on at least one further occasion" (Bryman 2008, p.49). This type of survey is more rare because of the cost and time involved (Bryman 2008). There are two general types of longitudinal design: panel and cohort studies. Panel studies survey a random sample of people at one point in time, and then survey the exact same people at a further point in time. A cohort study surveys a sample of people who were chosen on specific criteria, and then surveys people based on the same criteria (but not necessarily the same people) at another point in time (Bryman 2008). The longitudinal design tends to increase the internal validity, as compared to a cross-sectional design, due to the replicability of the survey and associated judgement of the influence of the independent variable on the dependent variable. In other ways, it is similar to the cross-sectional design, in that its strong external validity and possible weaknesses in the ecological validity. It is intuitively a useful design if considering measuring the 'time' element of the diffusion of innovations, for example, estimating the number of units of an innovation which have diffused at different points in time. This would be particularly useful if the innovations were quite new and in the process of diffusing during the research period. It is also useful in specific social network analysis studies which measure changes in ties over time (Christakis & Fowler 2007), and social capital relations to diffusion (Frank et al. 2004). However, it was not evident that reports of information-seeking would necessarily change over time. In addition, the costs and time frame presented important challenges.

The case study approach uses focused research on one or several cases to approach 'how' and 'why' questions posed by the researcher. This type of approach is explained in Chapter 6.

A comparative research design is one that "entails studying two contrasting cases using more or less identical methods" (Bryman 2008, p.58). Data may be collected in a

cross-sectional or longitudinal manner. Though the research setting could present an opportunity for comparative design due to the location of the villages being in different countries of the UK (England, Scotland and Wales), this type of design was not considered as the research questions do not necessitate comparison between villages.

A retrospective design examines historic information and was not considered here, as the research questions pertained to current activities.

Appendix Table 2 contains a summary of the types of research designs.

Appendix Table 2: Summary of research design types

Design type	Explanation	Categories
Experimental designs (1) Laboratory Experiments and Field Experiments	"A research design that rules out alternative explanations of findings deriving from it (i.e. possesses internal validity) by having at least a) an experimental group, which is exposed to a treatment, and a control group, which is not, and b) random assignment" (Bryman 2008, p.693-694). A laboratory experiment is "…conducted in a laboratory, where all external factors can be controlled" (Sarantakos 1993, p.243). Field experiments are similar to laboratory experiments, except "these experiments are performed not in a laboratory but in natural situations …" (Sarantakos 1993, p.243).	* One-group Pretest-Posttest Design (Campbell & Riecken 2006), i.e. an observation of one group before and after experiment * Pretest – Posttest Control Group Design (Campbell & Riecken 2006), i.e. observations before & after in group subjected to experiment, and group not subjected to experiment (control). According to Bryman (2001), this is the 'classic experimental design' (p.55). * Static Group comparison (Campbell & Riecken 2006), i.e. comparing a group that has experienced X with one that has not (no pretesting) * Solomon's two-control-group design, i.e. one experimental group & 2 control groups. The 2nd control group is exposed to the independent variable. * Solomon Four-Group design (Campbell & Riecken 2006), i.e. 2 experimental groups and 2 control groups. One experimental and one control have a pretest & posttest; the other experimental and control groups are only subjected to post-test. * Post-test only Control Group Design (Campbell & Riecken 2006), i.e. similar to Static Group comparison, but assign groups by random sampling. * Factorial designs "examine the direct effects ... of a number of independent variables ... to see how various combinations of characteristics work together to produce an effect" (Bryman 2001, p.66), and include simple 2x2 designs
Experimental designs (2) Quasi-experiments	Qausi-experiments are studies that have certain characteristics of experimental designs but that do not fulfil all of the internal validity requirements. Usually manipulation of experiment is not possible. This type of experiment does not always use random assignment. Replication in a variety of times & places is important (Campbell & Riecken 2006).	* Interrupted Time Series with Comparison Series (have a comparison group, not control) * Single Interrupted Time Series Design * The Pretest-Posttest Comparison Group Design * The One Group Before-and-After Design * The Posttest-Only Comparison Group Design * Natural Experiments (Bryman 2008), i.e. involves manipulation of a social setting, but as part of a naturally occurring attempt to alter social arrangement (Bryman 2008).[206]

[206] These are also considered another type of experimental design, along with laboratory and field experiments, by Bryman (2001).

Design type	Explanation	Categories
Cross-section design	"A cross-sectional design entails the collection of data on *more than one case* (usually quite a lot more than one) and at a *single point in time* in order to collect a body of *quantitative* or *quantifiable data* in connection with two or more variables (usually many more than two), which are then examined to detect *patterns of association*" (Bryman 2008, p.44).	If it is necessary to obtain a time dimension, one alternative from a simple cross-sectional design is to use repeated cross-sectional studies. This involves "collecting information at a number of different time points *but from a different sample at each time point*" (Bryman 2001, p.173).
Longitudinal design (1) Panel	Data are collected on the same sample on at least two occasions and do not usually employ randomised control groups (Bryman 2001).	* Simple prospective design: data is collected at two points in time (Bryman 2001) * Multiple point prospective panel design: data is collection at more than two points in time in order to track changes, determine effects over time, examine changes, etc. (Bryman 2001) * Single panel design without replacement: does not try to replace those who dropped out of the survey (Bryman 2001) * Single panel design with replacement: recruits new people to account for those who dropped out (Bryman 2001) * Rotating panel design: multiple panels are tested at multiple times, but each panel has a limited life which is staggered compared to the others (Bryman 2001)
Longitudinal design (2) Cohort	Data are collected on the different samples on at least two occasions and do not usually employ randomised control groups (Bryman 2001).	* Single cohort design: different people are tested at different points in time (usually focusing on a certain characteristic) (Bryman 2001) * Multiple cohort design: differs from single cohort design in the "spread of cohorts" (Bryman 2001, p.124). * Cohort sequential design: "uses multiple cohorts and has a form of panel renewable over time" (Bryman 2001, p. 124) * Retrospective panel design: collects historical data at multiple points in time (Byrman 2001)
Case study	Case studies are useful when a study has a few cases and many variables. A research design that entails the detailed and intensive analysis of a single or multiple cases.	* Explanatory, descriptive or exploratory * Theory-testing or theory-building * Single or multiple cases * Holistic or embedded units of analysis * Parallel or sequential: either conducted at the same time, or one after the other (Bryman 2001) * Retrospective or prospective: collecting data over an extended period and reconstructing history versus looking forward over time (Byrman 2001) (These are more fully discussed in Chapter 6)
Comparative or Cross-National design	"…this design entrails studying two contrasting cases using more or less identical methods" (Bryman 2008, p.58).	Examining contrasting studies using more or less identical methods (Bryman 2008) These are often incorporated into the designs mentioned above (e.g. posttest-only comparison group quasi-experiment design)
Retrospective / Historic	Historic data, does not use focus on contemporary events	These are often incorporated into the designs mentioned above (e.g. case study retrospective design)

Appendix C. SELF-COMPLETION QUESTIONNAIRE PRE-TEST

This appendix has six sections. The first section lists the Energy Saving Trust's 'Frequently Asked Questions' which are grouped into categories determined by the author in order to help determine which technical and behavioural innovations to include in the questionnaire. The second section lists the pre-test questions which were printed and formatted to allow sufficient space for answers. The third section outlines the first version of the questionnaire which was trialled with the author's personal contacts and with the local organising group members in North Leigh and St Athan. The fourth section outlines the second version of the questionnaire which was trialled in Alyth. There were actually two versions of this questionnaire which were sent, with one small difference: in 'The way we act in the house' section, half of the pre-test respondents received a version asking if they had done the actions in the past 7 days (which was followed on the next page by asking if they respondent had done the actions before the programme had started) and half of the questionnaires were in the opposite order. As the content was the same, only one version is included here, i.e. the version which first asked about actions previous to the programme, which was ultimately not used (see Appendix D for final questionnaire). The fifth section in this Appendix summarises the findings from the pre-test questionnaires. The sixth section summarises the changes made that were incorporated into the final questionnaire.

Energy Saving Trust 'Frequently Asked Questions'

The following questions, numbered 1 to 604 as per the website (EST, *Frequently asked questions*), are here listed in order to understand the types of questions for which people might seek information. They were grouped into categories by the author in order to parallel the questionnaire sections and to refine the information sources indicated in the questionnaire.

Insulation (wall & loft)

24 Are there any known problems with cavity wall insulation?
29 I'm not in receipt of any benefits. Is there any financial help to have loft and cavity wall insulation installed?
37 Does cavity wall insulation cause damp?
50 Does cavity wall insulation deteriorate over time?
54 Can I insulate the solid walls in my property?
59 Can cavity wall insulation be installed in all properties?
62 What is cavity wall insulation made of?
71 How much energy and money could be saved through insulation and draft proofing in the home?
74 Are there any restrictions regarding installing cavity wall insulation?
76 Is there any point in insulating the floors of my property?
83 Are there any grants for loft insulation?
93 Are there any grants for cavity wall insulation?
94 Why do I need to install roof ventilators before my loft can be insulated?
100 Can all cavity walls be insulated?
108 Where can I find out more about cavity wall insulation in existing housing?
109 Are there any grants available for solid wall insulation?

111 How much money does cavity wall insulation save?
114 To what depth should you insulate your loft?
118 Why am I being charged extra for scaffolding when the cavity wall insulation is being installed with a grant from my energy supplier?
126 Do I have to do anything before the installation of cavity wall insulation?
131 Where can I find out more about cavity wall insulation?
141 What are the benefits of installing cavity wall insulation?
146 How is cavity wall insulation installed?
148 How will I know that the cavities are completely filled?
151 How are suspended floors insulated?
153 My electric heaters don't heat my flat sufficiently. Are there grants available for improving the heating and insulation of my home?
154 Can you insulate between ceilings and the roof of a dormer bedroom constructed in a bungalow?
156 How much money does loft insulation save?
157 How will cavity wall insulation affect the appearance of my house?
161 My house was built before the 1920s, will it have cavity walls that I can insulate?
162 What is loft insulation made of?
171 Where can I find out more about internal wall insulation in existing housing?
173 Does cavity wall insulation require servicing or maintenance?
177 Where can I find a registered cavity wall insulation installer?
178 How will I know if the walls of my house have cavities?
179 Is cavity wall insulation expensive?
180 I live in a ground floor flat with cavity walls. Is it possible to get cavity wall insulation for just my flat or would it have to be for the whole building?
183 How long will it take to install loft insulation?
192 Which should I do first: insulate my home or replace my boiler?
196 What methods are used when insulating solid floors?
199 How long will it take to install cavity wall insulation?
201 Does the cavity wall insulation installer have to come into the house?
203 Is it possible to insulate a flat roof?
208 Are there grants for under floor insulation
209 How far is it possible to go in terms of insulating existing properties?
222 I am elderly and can't empty my loft for it to be insulated. Who can help?
226 Where can I find information on the most energy efficient insulation materials?
229 We are interested in having wall cavity insulation but we have defective wall ties. Do we have to get wall ties repaired first?
231 I'm in receipt of a benefit, is it true I can have my home insulated at no cost?
234 Can insulation help with condensation?
235 How much heat is lost from a roof?
237 What percentage of heat is lost through uninsulated walls?
241 Why should I consider having loft insulation?
255 Are there insulation and heating grants for people who are under 60 and on benefits?
266 Will there be any need to insulate walls again after 25 years?
276 How does the installation of cavity wall insulation affect ventilators in the external wall?
307 What is a cavity wall?
346 Do you have information on Structural Insulated Panels (SIPs)?
353 What funding is available for the insulation of mobile homes?
357 What is insulation?
377 Can insulation affect respiratory problems and skin disorders?
391 Is the government really banning traditional incandescent bulbs?
402 How do I find out how to externally insulate dwellings?
544 Is there a of the advantages of working to Best Practice heating and insulation standards in social housing?

Low energy lighting

1 Is it true that you use more energy to turn lights on and off than to leave them running?
35 Is it true that energy saving lightbulbs are more economical if they are left on for long periods of time rather than switched off and on?
39 Can Compact Fluorescent Lamps be used with dimmer switches?
55 How much energy is used in lighting in the home?
137 Don't energy saving lightbulbs take a long time to light up?
138 Are halogen lamps more efficient than standard tungsten lamps?
147 If a lampshade is rated for a maximum 40 watts how large an energy saving bulb can I use with it?
149 How much money do energy saving lightbulbs save?
185 Are energy saving lightbulbs only available in those long thin shapes?
204 What is a CFL?
312 Are florescent tube lamps more efficient than tungsten lamps?

321 Are low voltage lamps more efficient?
327 Do energy saving lightbulbs really last longer than a tungsten bulb?
335 Doesn't switching lights on and off use more energy than leaving them running?
343 What do I do if an energy saving bulb breaks?
358 Lots of my lights have dimmer switches. Can I fit them with energy saving bulbs?
366 Are Compact Fluorescent Lamps available in Edison screw and Bayonet cap fitting?
367 Are halogen bulbs more efficient than traditional bulbs?
368 Don't CFLs contain mercury? And isn't that bad for the environment?
371 Do you have any examples of local authorities using green streetlighting?
383 Producing an energy saving bulb must take more energy in the first place than making a standard bulb. At the end of the day, doesn't that make it inefficient?
399 Don't traditional bulbs give a better quality of light?
403 Is there any design advice available for low energy lighting in dwellings?
404 Do you have any information showing cost comparisons between conventional and energy efficient lights?
411 Doesn't switching lights on and off use more energy than leaving them running?
431 Don't energy saving lightbulbs take a long time to light up?
471 When selecting lamps, what does the manufacturer's reference mean?
477 What type of lighting is best suited for the visually impaired?

Highly efficient appliances & heating systems

16 I live in an old 3 bedroomed cottage that has electric storage heating. As I don't have access to mains gas, is this the most cost effective option open to me?
22 Is it more economical to leave my heating on 24hrs in the winter?
25 How much energy can be saved by switching off appliances rather than leaving them on standby?
33 Do computers use a lot of energy?
41 How much energy can be saved by using efficient electronic equipment and switching things off standby?
43 How much washing-up do I need to have before it's worth using a dishwasher rather than a hand wash?
44 Is my house/site suitable for a heat pump?
46 Is a combination boiler more efficient than a conventional boiler?
48 Is it cheaper to use an immersion heater in the summer rather than the gas fired central heating boiler?
58 Won't turning my hot water heater on and off cost me more in the long run?
63 Are electric storage heaters as cost effective as gas central heating?
65 Our boiler is 20 years old, is it worth replacing to save energy?
67 Can I fit a Ground Source Heat Pump and under-floor heating into an older style property?
69 Do you have any guidance on optimal sizing of replacement boiler systems for domestic housing?
72 What are the typical running costs of household appliances?
73 Is it true that leaving electrical appliances such as TVs, CD players, monitors etc on standby uses very little energy and means the warm up time is reduced?
75 What temperature should my room thermostat be set at?
78 What setting should my boiler be set at?
82 Can solar heating provide central heating as well as hot water?
88 Is a hot fill washing machine more efficient than a cold fill machine?
101 I need to replace my boiler but the engineer says he'll have to change the system, is that correct?
104 What is special about condensing boiler technology?
110 How should I set my central heating programmer?
115 Are condensing boilers over complicated and unreliable?
117 Is it true that freezers cost less to run if they are full?
127 Which are the most efficient radiators to use?
128 How much energy can be saved by using efficient Washing Machines, Tumble Dryers and Dishwashers?
132 Should I replace my conventional boiler with a combi boiler?
133 How much energy and money could be saved through improved heating in the home?
134 Should I buy a gas or electric oven and hob?
136 Do chargers used with portable equipment continue to use electricity after it has fully charged?
139 My house is fully insulated and has a new gas condensing boiler. What more can I do to save money off my fuel bills?
150 My boiler is very noisy and the engineer says it's kettling. What does that mean and how is it cured?
159 How much energy can be saved by using efficient Fridges/Freezers?
163 Is it true that a high efficiency condensing boiler is only more efficient if the radiators are oversized?
165 I want to replace my old boiler, how do I know what size of new boiler to get?
166 What do the numbers on a thermostatic radiator valve mean?

168 Is it better to toast bread under an electric grill or in a toaster?
169 What's the best way to operate electric storage heaters?
172 Should I switch off power to video recorders and other appliances that remember settings?
189 Are microwave ovens more efficient than standard ovens?
192 Which should I do first: insulate my home or replace my boiler?
207 What should I set my thermostat to on my electric hot water heater?
210 How do I work out the running cost of an appliance?
212 My room thermostat is in the living room and I find that the rest of the house is cold, why is that?
213 Why does a combination boiler need a bigger gas supply compared to an ordinary boiler?
214 Is warm air central heating as efficient as radiators?
218 How can I use my washing machine more efficiently
223 I have gas wall heaters and gas fires in my house. Is this as efficient as a full gas central heating system?
224 What are the Best Practice options for electric heating?
227 How can I cook more efficiently?
228 What's a U value?
230 How can I save energy when using a kettle?
242 Is it more efficient to have a large hot water cylinder or a small one?
255 Are there insulation and heating grants for people who are under 60 and on benefits?
258 How much energy can be saved by using efficient appliances?
268 How much carbon dioxide is produced by leaving a TV on standby?
296 My boiler is in the airing cupboard with a built in programmer. I can't see it to adjust it, what are my options?
297 Why should I get a room thermostat fitted?
303 My installer has recommended I buy a combi boiler. What type of boiler is it?
313 I understand there is a gas tumble drier on the market. Does it produce more or less carbon dioxide than electrical dryers?
328 What is a heat pump and how does it work?
329 What is solar gain and how can I maximise its benefits?
330 Are there different types of solar collectors and what options are available?
331 What should I look for when buying a tumble dryer?
333 How do I know if my stream is able to power a micro hydro turbine?
336 How do Solar Photovoltaic panels work?
339 How often should I get my gas boiler serviced?
340 What assessment procedure is there for the installation of condensing boilers in order to comply with the Building Regulations?
341 What information is there regarding the integration of renewable energy into existing dwellings?
347 Are microbore pipes as good as larger pipes?
349 What is micro hydro and how does it work?
355 What should I look for when I'm buying a new washing machine or dishwasher?
360 What is a small scale renewable energy system and where can I find out more information about it?
362 How is an appliance's energy rating worked out?
364 You are currently encouraging people to 'turn to 30' for their washing. I am aware of washing temperatures much lower than this as standard in other countries. Is this really as energy efficient as it could be?
369 What is a programmable room thermostat?
370 Can wood pellet boilers be installed in smoke controlled areas?
374 What sort of heating controls should I fit on my gas central heating?
375 Can heat pump systems provide cooling?
382 How do I know if my house is suitable for biomass?
388 Do you have any guidance on choosing domestic solid fuelled boiler systems?
394 What do Solar PV cells look like?
395 Can I have a condensing solid fuel boiler?
397 Do you have any practical examples where biomass CHP and other renewable energy technologies have been successfully integrated during dwelling refurbishment?
400 I have an energy efficient product, how do I get it certified by you?
405 I have a gas fire and wondered if I should have a carbon monoxide detector fitted?
407 Will biomass be able to provide all the heating for my house?
421 Is it difficult to integrate a solar space heating collector into a new roof?
424 Which renewable energy technologies are most suited to urban applications?
427 How do I check if my room thermostat is working?
432 I have purchased a solar thermal system and wish to use the heated water to wash my clothes. However, you do not endorse any and I cannot seem to find one. Why is this?
436 Are there any appliances that run on solar energy?
441 How much does an 'A' rated washing machine save compared to my old machine?
447 Does my new boiler have to meet any minimum standards or regulations?
461 With renewable technologies, what is an inverter and what does it do?
464 If a washing machine or dishwasher is 'A' rated does this mean that all functions meet the A

standard?
468 How much carbon dioxide does my gas boiler produce?
478 Is it difficult to integrate a solar space heating collector into a new roof?
483 Where can I find a supply of wood chips or pellets?
486 I am looking for guidance on passive solar design for new build developments?
497 What does thermal conductivity mean?
498 Do you have any recommendations on estate layout taking into account passive solar?

Draught-proofing / Windows

71 How much energy and money could be saved through insulation and draft proofing in the home?
122 Why does condensation appear between the panes of my double glazed windows during the winter?
186 How much heat is lost through single glazed windows?
195 Why do I need trickle vents in my new double glazing?
205 What is “Low-E” double glazing?
216 What is the difference between double glazing and secondary glazing?
217 Is there anything I can do to make my house less draughty?
219 Can I install double glazing on a ‘Do-It-Yourself’ basis?
238 Can you install double glazed doors and windows on listed buildings?
240 Are there any differences in the energy performance of timber and uPVC windows?
245 What are the benefits of double glazing?
256 Is there anything I can do to stop the draughts around my skirting boards?
260 Are there any grants for draught proofing my home?
279 What is a U-value?
282 How does double glazing reduce heat loss?
320 What are the Best Practice requirements for energy efficient glazing?
384 What is low-e glass technology?

Ventilation

365 Which is the most efficient type of ventilation for new build and when refurbishing dwellings?
396 What are the ventilation requirements of different heating appliances?
470 Where can I find information on reducing air leakage from dwellings?

Tariffs / Energy supply

379 What is green electricity?
389 Where can I get information on renewable energy suppliers/installers?
410 My mother lives on her own and she is becoming forgetful. I'm worried that she will forget to pay her fuel bill and get cut off - is there anything I can do?
439 How do I change my energy supplier?
561 Is switching energy suppliers complicated?

Other: cost / grants / support

2 What levels of grants will be available from the low carbon buildings programme?
6 What funding is available for boiler replacements?
9 How much money can I save off my electricity bill by installing a Solar Photovoltaic (PV) system?
10 How much does a micro wind turbine cost and how much electricity does it generate?
12 How much does Solar PV cost, will costs fall, and how much electricity does it generate?
13 Are there any grants available for under floor heating and solar hot water panels?
34 Who can apply for a low carbon buildings programme grant?
15 How much does a ground source heat pump cost and how much money can it save?
80 How much funding is available under the low carbon buildings programme?
81 Are there any grants for installing double glazing?
83 Are there any grants for loft insulation?
96 Can I get a Low Carbon Buildings grant if I install the equipment myself?
109 Are there any grants available for solid wall insulation?
112 Why aren’t there grants available for the installation of double glazing?
118 Why am I being charged extra for scaffolding when the cavity wall insulation is being installed with a grant from my energy supplier?
144 How can I save energy without spending any money?
153 My electric heaters don't heat my flat sufficiently. Are there grants available for improving the heating and insulation of my home?

156 How much money does loft insulation save?
179 Is cavity wall insulation expensive:?
188 What are the typical cost savings and payback times for the most common energy efficiency measures?
191 How much funding is available from the low carbon buildings programme, and over what period?
208 Are there grants for under floor insulation
255 Are there insulation and heating grants for people who are under 60 and on benefits?
260 Are there any grants for draught proofing my home?
392 Is there any funding available through CAfE?
420 What support is available for schools?
423 What type of projects are eligble for funding under the Northern Ireland Projects Fund?
435 Are there any grants available for hydrogen fuel cell vehicles?
446 How do I apply for funding through the Northern Ireland Projects Fund?
455 What organisations are eligible for free EST Travel Plan consultancy?
467 Is there any funding available for community centres or churches?
480 What funding is available through the Northern Ireland Projects Fund?
513 Is there support available for community centres or churches?
567 Do all Energy Saving Trust programmes apply to Northern Ireland?
568 How are Northern Ireland Project Fund applications assessed?
569 When can I claim funding through the Northern Ireland Projects Fund?
593 We want to reduce our organisation's fuel costs. Can you help?
594 We are a nationwide company with a head office in Wales. Are we eligible for consultancy?
599 How can I influence decisions on energy efficiency investments?

Other: trust

101 I need to replace my boiler but the engineer says he'll have to change the system, is that correct?
177 Where can I find a registered cavity wall insulation installer?
281 I need to have a new boiler fitted but I don't want a 'cowboy' plumber, where should I go for advice?
376 Do you certify/work with this product/installer/company?

Other: Information (general)

249 Where can I find detailed information on energy consumption, energy efficiency and sustainable energy?
319 Is there a one-stop-shop for all my energy efficiency and supply needs?
332 Do you have any guidance on how to improve the levels of energy efficiency in historic properties?
334 What does the energy label mean?
337 Where can I find data on the savings associated with the installation of energy efficiency measures?
342 What are the emissions standards for the London Low Emission Zone (LEZ)?
361 Do you have a case study on zero energy dwellings?
372 How can I estimate the energy requirements of my house?
378 What savings can I make if I buy an Energy Saving Recommended appliance?
386 Whats the difference between the Energy Saving Recommended logo and the Energy Saving Trust logo?
390 I have a product which is extremely energy efficient. Why do you not endorse it?
393 What methods are commonly used for assessing the energy efficiency of dwellings?
401 I know about the benefits of energy efficient lighting but where can I find more detailed guidance regarding specifying and installation?
408 Where can I find more information about the London Low Emission Zone (LEZ)?
412 This product is complicated to make/dispose of. Why do you endorse it as energy saving?
413 What can be done for properties off the gas network?
414 I have a suggestion. Where can I send it?
416 Do you have a case study of an environmentally sustainable and self sufficient housing project?
419 How much of the UK's carbon dioxide emissions are due to the domestic sector?
422 What is an energy club?
425 What is fuel poverty and how is it linked to 'hard to treat' homes?
429 What is a calorific value?
440 What does this A+ and A++ rating mean?
442 Where can householders find information on purchasing energy efficient products?
444 I want more information about the energy consumption of a product/the criteria by which you endorse a product. How would I go about
445 What are the benefits of energy services for social housing?
448 Do you have any information on providing energy advice to tenants?
451 What are the Energy Saving Trust doing to try and reduce the energy consumption of household

products?
452 Where can I get energy efficiency promotional material?
453 What is the role of the Energy Saving Trust's Office in Northern Ireland?
454 How do you improve 'hard-to-treat' dwellings, when the most cost-effective energy efficiency measures are not practical?
458 What is the Priority Service Register?
459 What proportion of UK energy is produced by renewables?
462 What is the most effective method of giving energy efficiency advice?
465 What is green procurement?
469 How do I find out more about CAfE training sessions?
473 Do you have any information on the thermal performance of housing stock in Scotland?
475 What is the flower symbol on some energy labels?
481 Is there any information available on homes that are self-sufficient in energy?
482 Do you have case studies of new build housing association schemes that demonstrate improved energy efficiency standards?
485 When is energy saving week and how can we get involved?
488 Is there a general guide available giving details on energy efficient refurbishment and Best Practice specifications?
489 What specifications are required to reach Best Practice standards for Northern Ireland?
490 Do you have a case study of innovative social housing design?
494 Are there any national and regional figures I can use for comparing my local authority's SAP ratings?
495 I have a new/existing product, can I have EST support for the related marketing campaign/how can you help me?
496 Which appliances does the European energy label scheme cover?
499 What is the Low Carbon Research and Development programme?
500 Do you have any information on the thermal performance of housing stock in Northern Ireland?
501 Is there any guidance summarising the advantages of communal heating systems?
516 Do you have any information on how I can make my mobile home more energy efficient?
518 Is there any energy efficiency Best Practice guidance available for garage conversions?
519 Is there any energy efficiency Best Practice guidance available for domestic extensions?
520 What is meant by a "technology neutral approach"?
527 Where can I find out about robust house details?
540 What are the benefits of green procurement?
542 Do you have any guidance on whole life costing relevant to new build projects?
547 Do you have any case study examples of a Best Practice district council?
557 What is natural gas?
559 If I am not eligible for on site consultancy what advice can you give me?
564 What are the energy consumptions of the goods that you endorse and why are these not on the website?
565 Do you have any information on the energy consumption of schools?
566 How does my electric fire produce carbon dioxide?
571 I have been asked to vote for stock transfer, can you explain what this means?
574 How do you refurbish high rise buildings to Best Practice levels?
576 Do you have a case study for registered social landlords describing low energy new build housing?
595 Our organisation is based in Ireland. What help can you give us?
602 How can the Energy Saving Trust help with energy services?

Other: Transport

338 What should I look for from an environmental point of view when choosing a car?
348 How much do electric vehicles cost?
350 Why is my vehicle not on the powershift register?
351 What would happen if I ran out of LPG?
352 What level of daily charge is set for the London Low Emission Zone (LEZ)?
373 Where can I buy bioethanol?
380 Who should I contact to discuss proposals for transport marketing, advertising and sponsorship activities?
385 What are the benefits of biodiesel
398 What is Biodiesel?
406 Are grants available for flex fuel bioethanol vehicles?
409 How do natural gas vehicles compare to their petrol or diesel equivalents?
426 What are the benefits of hybrids?
430 What is a Travel Plan?
437 What natural gas vehicles are available in the UK?
438 Where could I refuel a Natural Gas Vehicle?
449 How do hybrids compare to standard petrol or diesel models?
450 What is the difference between Compressed Natural Gas and Liquefied Natural Gas?
456 With Travel Plan consultancy, what costs are covered for free & what would we have to pay for?

460 What vehicles can use bioethanol as fuel?
463 Are 4x4s bad for the environment?
466 What information is available for cycling and walking?
474 How is the fuel stored onboard a natural gas vehicle?
476 Can I get practical ecodriving training?
487 What are the benefits of Travel Plans?
491 How will the hydrogen for fuel cell vehicles be produced?
492 How much fuel & money can I save by ecodriving?
502 What is LPG?
503 Where can I buy an LPG car or van?
504 How much extra do hybrids cost?
505 What is a fuel cell?
506 What are the environmental benefits of fuel cell vehicles?
507 What should I expect from a Fleet Management or Travel Plan consultancy?
508 How does bioethanol compare with conventional fuels?
509 Where can I buy a flex fuel bioethanol car or van?
510 How much money will I save on fuel if I switch to bioethanol?
511 Is the Government going to increase the tax on bioethanol?
522 Where can I find out about car-sharing or lift-sharing schemes?
523 What are car clubs?
524 Where can I find out about car clubs (joint-ownership schemes)?
525 How much Travel Plan consultancy would my organisation receive?
526 What is a hybrid vehicle?
528 How do I recharge a hybrid's batteries?
529 How do I recharge an electric vehicle?
530 How much will I save on fuel if I buy an electric vehicle?
531 When will I be able to buy a fuel cell vehicle?
532 Does ecodriving just mean slowing down?
533 Who can apply for free fleet management consultancy?
534 Can I convert my vehicles to operate on bioethanol?
545 What are the benefits of EST's Fleet Management consultancy?
546 What organisations are eligible for free EST Fleet Management consultancy?
548 How much Fleet Management consultancy would my organisation receive?
549 With Fleet Management consultancy, what costs are covered for free & what would we have to pay for?
550 How is the Travel Plan & Fleet Management consultancy funded?
551 How do I apply for free Travel Plan or Fleet Management consultancy?
553 What are the environmnetal benefits of LPG?
554 What is a "stop-start" or "micro-hybrid"?
555 Is there any guidance or information on fuel cell technology?
556 How much will my mpg be improved if I switch to a hybrid?
558 How fast can electric vehicles go?
560 Our organisation is based in Wales. What help can you give us with our fleet?
562 How can I set up a car sharing scheme at work?
563 What is bioethanol?
575 Where can I find out more about local public transport?
577 What cost savings can I expect if I implement the Fleet Management consultant's recommendations?
579 What is a natural gas vehicle or NGV?
580 What is an electric vehicle?
581 How far can electric vehicles go?
582 How long does it take to recharge an electric vehicle?
583 What are the environmental benefits of electric vehicles?
584 What is a fuel cell vehicle or FCV?
585 Can I buy a fuel cell vehicle?
586 How will fuel cell vehicles be refuelled?
587 Are there any other benefits of ecodriving?
588 Are there any other terms for ecodriving?
589 I would like to apply for a Green Fleet Review. Is this a free service?
590 How do I apply for free Travel Plan consultancy?
591 How do I apply for free Fleet Management consultancy?
592 Our organisation is based in Northern Ireland or Wales. What help can you give us with our fleet?
596 What are the environmental benefits of bioethanol?

Other: Regulations and related matters

344 What are the minimum and Best Practice specifications for Central Heating Systems resulting from 2005 revisions to the building regulations?
345 What is the Renewables Obligation and how does it work?
354 What are the aims of the low carbon buildings programme?

356 What are the VAT regulations relative to renewable technologies?
363 What is an abatement system for the London Low Emission Zone (LEZ)?
387 What is the Code for Sustainable Buildings?
415 Can I improve on the regulatory minimum when building new dwellings?
418 What is State Aid?
433 Have changes been made to the Energy Saving Recommended certification mark to reflect the higher standards in the EU labels?
443 How do I know if an abatement system is approved for the London Low Emission Zone (LEZ)?
472 The new Building Regulations Part L1 require greater appreciation of the potential for new dwellings to overheat during the summer. Do you have any guidance on this?
479 What are the changes to the Building Regulations for 2006?
484 What is the Housing Act?
514 Who is responsible for energy policy and energy efficiency in Northern Ireland?
535 How many councils have signed up to the Nottingham Declaration on Climate Change?
541 What is the Refuelling and Infrastructure programme?
552 What is meant by State Aid rules?
570 Are there separate building regulations for Wales?
578 To what organisations do State Aid rules apply?
597 Where can I obtain a copy of the Nottingham Declaration on Climate Change?
600 What is the difference between the various housing standards?
601 When will round eight of the HECA reports be available?
603 Is there a time limit on claims for funding from the Northern Ireland Projects Fund?

Other: Non-energy questions

359 What is the difference between rainwater harvesting and grey water recycling?
537 Do you have any information on environmental coatings and paints?

Other: Renewable energy

493 What are the environmental benefits of using small scale renewables?
512 What is wind energy and how does it work?
536 Why do you not accredit renewables/microgeneration products?

Other: communities

381 Which organisations would benefit most from becoming members of the CAfE network?
457 Do you have any biomass community heating scheme case studies?
515 Is there any practical advice available on the benefits and opportunities of community heating?
517 Do you have any case studies of community heating in new build housing?
521 Do you have any guidance on sustainable communities?
538 Do you have some energy saving tips I can give to local residents?
539 How do I find other like minded people / community organisations in my area?
543 Do you have any example case studies of community heating in a refurbishment scheme?
572 What are the benefits of joining the CAfE network?
573 Where can I go for more information on specific energy related community queries?
598 Do you have any information about fuel poverty mapping?
604 How do I become a CAfE member?

Pre-test questions given to respondents

Below is the general text which was given in either print or email form to potential respondents of the pre-test questionnaires. Wording differed in small ways for each community, but the same basic questions were asked.

“Thank you very much for taking the time to fill in my questionnaire. If you could help me refine the questionnaire by answering the following questions, and adding your own comments, that would be such a big help.

Many thanks in advance!

How long did it take you to fill out the questionnaire? Please give approximation, if you didn't time it.
Do you have any reactions to the packaging (i.e. the envelope the questionnaire came in, how things were arranged in the envelope, etc.), either positive or negative? What are those reactions?
Did you notice a letter inside the packet?
Did you read the letter? Was there anything in the letter that you liked or didn't like?
On a scale of 1 to 5, where 1 means very easy and 5 means very difficult, how easy or difficult was it for you to figure out where to begin on the form?
Do you have comments about the format of the questions and the questionnaire?
Was there any particular section that took longer to fill out? If so, was this because it was more difficult, or hard to remember what was being asked?
Do you have any comments about the wording of questions? Is there anything you didn't understand?
Did you become bored at any point? If so, which section or question number?
Do you think the questionnaire flowed well?
Are there any energy efficiency items (like appliances, electrical equipment, etc) or actions (like closing curtains when it's cold) that you think are missing?
Are there any energy efficiency items (like appliances, electrical equipment, etc) or actions (like closing curtains when it's cold) that you think are included and perhaps shouldn't be? If so, could you please tell me why?
Are there any obvious spelling (or other) mistakes?
Any other comments?

May I contact you to discuss anything, in case there is something you brought up that I haven't considered or to get more detail? If so, could you please write you name and email address (or phone number, if you prefer) here?

Thanks again! If you could include this in the return envelope with the complete questionnaire, that would be fantastic and very much appreciated."

Pre-test questionnaire – Version 1

The next twelve pages contain an example of the first version of the pre-test questionnaire.

University of Reading

The University of Reading
School of Construction Management and Engineering
URS Building, PO Box 219
Whiteknights
Reading
RG6 6AW

Energy Efficiency in your Community

This questionnaire has 7 sections which will ask you about what you have considered regarding energy efficiency in your home. In addition, some questions ask about people you may have spoken to, or gotten information from, about energy efficiency.

How to answer the questionnaire

Most of the questions can be answered by putting a tick in the box next to the answer that applies to you. You are sometimes told to skip over some questions in this survey. When this happens, you will see an arrow with a note that tells you what question to answer next, like this:

- ☐ Yes
- ☐ No → (Skip to Question 5)
- ☐ Don't know → (Skip to Question 5)

Four sections will ask about energy efficiency items or actions you might have undertaken. Please read all the answer categories and tick the one that applies to your household. They will look like this:

	Not applicable	Installed before September 2007	Installed after September 2007	Have ordered it, waiting for installation	Planning to order & install	Considered, and still deciding	Considered, but decided against	Did not consider
Have you considered or installed insulation?	☐	☐	☐	☐	☐	☐	☐	☐

There are also questions that ask about people you know. We ask for you to tell us their first name and the first initial of the surname, so that you will remember them when we ask about them later in the questionnaire. The answer options will look like this:

First Name *(please write)* _____ First initial of surname *(please write)* ___

If you don't know the answer to any question, please give your best guess, or skip that question.

Confidentiality

Your data will be treated in strict confidence in accordance with the Data Protection Act, and the information will only be used for statistical purposes.

Return

When you have finished answering the questionnaire, please return it to us in the reply paid envelope provided.

THANK YOU AGAIN FOR YOUR HELP

Section A: Household energy use & your community

1 **How long have you lived in North Leigh?**

- ☐ Less than 12 months
- ☐ More than 12 months but less than 2 years
- ☐ More than 2 years but less than 3 years
- ☐ More than 3 years but less than 5 years
- ☐ More than 5 years but less than 10 years
- ☐ More than 10 years but less than 20 years
- ☐ 20 years or longer
- ☐ Don't know

2 **How satisfied or dissatisfied are you with your area?**

- ☐ Very satisfied
- ☐ Satisfied
- ☐ Neither satisfied nor dissatisfied
- ☐ Dissatisfied
- ☐ Very Dissatisfied
- ☐ Don't know

3 **Would you say you are aware of the Challenge North Leigh project which has been running since September 2007?**

- ☐ Yes
- ☐ No → (Skip to Question 5)
- ☐ Don't know → (Skip to Question 5)

4 **Have you had any discussions, or has it come up in conversation, about anything concerning the Challenge North Leigh project?**

- ☐ Yes
- ☐ No
- ☐ Don't know

5 **If you had a question about energy use in your home, what would be the FIRST thing you'd do to get information?** Please tick one.

- ☐ Read newspapers, magazines, journals
- ☐ Listen to the radio or watch television
- ☐ Ask someone I know (for example: friend, relative, colleague, acquaintance)
- ☐ Check sources on the internet
- ☐ Approach an organisation or group (for example: local council, energy advice centre, energy company)
- ☐ Don't know

6 The following questions are about **people you personally know right now**.

If you know anyone who fits the question, please tick 'yes' and then say how you know them by ticking the appropriate box under 'How do you know them?' If you do not know anyone who fits the item question, please tick 'no' and go to the next item (a-j).

If you know more than one person who fits each question, that's fine, please tick any box that fits how you know them.

					How do you know them? Please tick as many as apply						
	Do you know anyone who …	No	Yes		Immediate Family	Wider family	Friend	Neighbour	In North Leigh but not immediate neighbour	Colleague	Acquaintance
a	… would give you sound advice on energy efficiency?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
b	… would help you find information on energy efficiency?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
c	… would give you sound advice on changing day-to-day activities to help reduce energy use in your home?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
d	… would give you sound advice on real-time energy displays (i.e. smart meters or current cost monitors)?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
e	… would give you sound advice on insulating your house?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
f	… can explain the pros and cons of having a smart meter installed?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
g	… would give you sound advice on energy efficient of heating systems?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
h	… would give you sound advice on energy efficient appliances for your kitchen?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
i	… is an electrician or works directly with electrical equipment?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
j	… knows a lot about DIY?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐

Section B: Walls, windows, doors & floors

7 **Which of the following have you considered (or purchased or acquired) for the walls, window, doors and floors (or lofts) of your home?** Please only tick one box for items *a* through *j*.

		Installed before September 2007	Installed after September 2007	Have ordered it, waiting for installation	Planning to order & install	Considered, and still deciding	Considered, but decided against	Did not consider	Not applicable
a	Cavity wall insulation	☐	☐	☐	☐	☐	☐	☐	☐
b	Solid wall insulation	☐	☐	☐	☐	☐	☐	☐	☐
c	Loft insulation	☐	☐	☐	☐	☐	☐	☐	☐
d	Floor insulation	☐	☐	☐	☐	☐	☐	☐	☐
e	Door draught-proofing	☐	☐	☐	☐	☐	☐	☐	☐
f	Window draught-proofing	☐	☐	☐	☐	☐	☐	☐	☐
g	Skirting board draught-proofing	☐	☐	☐	☐	☐	☐	☐	☐
h	Heavy curtains for windows or doors to keep heat in	☐	☐	☐	☐	☐	☐	☐	☐
i	Double-glazed windows	☐	☐	☐	☐	☐	☐	☐	☐
j	Secondary-glazed windows	☐	☐	☐	☐	☐	☐	☐	☐

8 From time to time, people discuss matters with others to get information. **Thinking about insulation, draught-proofing or double/secondary glazing of windows as above, who have you discussed these with since September 2007?** Please fill in their first name and the first initial of surname.

First Name *(please write)* _____ **First initial of surname** *(please write)* _____

If you did not discuss these matters with anyone → (Skip to Question 20)

9 **Did this person seem in favour of insulation, draught-proofing or changing windows, or not?**

☐ In favour ☐ Neither in favour, nor not in favour ☐ Not in favour ☐ Don't know

10 **How do you know them?**

☐ Immediate family ☐ Wider family ☐ Friend ☐ Neighbour ☐ Colleague ☐ Acquaintance

11 **Do they live in North Leigh?**

☐ Yes ☐ No ☐ Don't know

12 **Still thinking about insulation, draught-proofing or double/secondary glazing of windows, who else did you discuss it with since September 2007?**

First Name *(please write)* _____ **First initial of surname** *(please write)* _____

If no one else → (Skip to Question 20)

		In favour	Neither in favour, nor not in favour	Not in favour	Don't know
13	**Did this person seem in favour of insulation, draught-proofing or changing windows, or not?**	☐	☐	☐	☐

		Immediate family	Wider family	Friend	Neighbour	Colleague	Acquaintance
14	**How do you know them?**	☐	☐	☐	☐	☐	☐

		Yes	No	Don't know
15	**Do they live in North Leigh?**	☐	☐	☐

16 **Did you discuss insulation, draught-proofing, or double/secondary glazing of windows with anyone else since September 2007?**

First Name *(please write)* _____ **First initial of surname** *(please write)* _____

If no one else → (Skip to Question 20)

		In favour	Neither in favour, nor not in favour	Not in favour	Don't know
17	**Did this person seem in favour of insulation, draught-proofing or changing windows, or not?**	☐	☐	☐	☐

		Immediate family	Wider family	Friend	Neighbour	Colleague	Acquaintance
18	**How do you know them?**	☐	☐	☐	☐	☐	☐

		Yes	No	Don't know
19	**Do they live in North Leigh?**	☐	☐	☐

Section C: Visual displays of energy use

20 **Which of the following have you purchased, acquired or considered for your home?**

		Is now installed or already did	Already installed, but stopped using	Have ordered it, waiting for installation	Planning to get	Considered and still deciding	Considered but decided against	Did not consider
a	Smart meter	☐	☐	☐	☐	☐	☐	☐
b	Current cost monitor	☐	☐	☐	☐	☐	☐	☐
c	Infrared imaging of your home (to identify heat loss)	☐	◙	☐	☐	☐	☐	☐

21 **Thinking about smart meters, current cost monitors, and infrared imaging, who did you discuss it with since September 2007?**

First Name *(please write)* _____ **First initial of surname** *(please write)* _____

If you did not discuss these matters with anyone → (Skip to Question 33)

		In favour	Neither in favour, nor not in favour	Not in favour	Don't know
22	**Did this person seem in favour of smart meters, current cost monitors or thermal infrared imaging, or not?**	☐	☐	☐	☐

		Immediate family	Wider family	Friend	Neighbour	Colleague	Acquaintance
23	**How do you know them?**	☐	☐	☐	☐	☐	☐

		Yes	No	Don't know
24	**Do they live in North Leigh?**	☐	☐	☐

25 **Still thinking about smart meters, current cost monitors, and infrared imaging, who else did you discuss it with since September 2007?**

First Name *(please write)* _____ **First initial of surname** *(please write)* _____

If no one else → (Skip to Question 33)

		In favour	Neither in favour, nor not in favour	Not in favour	Don't know
26	**Did this person seem in favour of smart meters, current cost monitors or thermal infrared imaging, or not?**	☐	☐	☐	☐

		Immediate family	Wider family	Friend	Neighbour	Colleague	Acquaintance
27	**How do you know them?**	☐	☐	☐	☐	☐	☐

		Yes	No	Don't know
28	**Do they live in North Leigh?**	☐	☐	☐

29 **Did you discuss smart meters, current cost monitors, or infrared imaging with anyone else since September 2007?**

First Name *(please write)* _____ **First initial of surname** *(please write)* _____

If no one else → (Skip to Question 33)

		In favour	Neither in favour, nor not in favour	Not in favour	Don't know
30	**Did this person seem in favour of smart meters, current cost monitors or thermal infrared imaging, or not?**	☐	☐	☐	☐

		Immediate family	Wider family	Friend	Neighbour	Colleague	Acquaintance
31	**How do you know them?**	☐	☐	☐	☐	☐	☐

		Yes	No	Don't know
32	**Do they live in North Leigh?**	☐	☐	☐

Section D: Appliances and heating

33 Which of the following have you purchased, acquired or considered for your home?

		Installed before September 2007	Installed after September 2007	Have ordered it, waiting for installation	Planning to order	Considered, and still deciding	Considered, but decided against	Did not consider
a	Boiler or heating system upgrade	☐	☐	☐	☐	☐	☐	☐
b	Heating controls (for boiler or radiators)	☐	☐	☐	☐	☐	☐	☐
c	Radiator reflectors/panels (to reflect heat into room)	☐	☐	☐	☐	☐	☐	☐
d	'A' rated large appliances (such as: refrigerator, dishwasher, washing machine)	☐	☐	☐	☐	☐	☐	☐

34 Thinking about energy efficient appliances or heating, who did you discuss it with since September 2007?

First Name *(please write)* _____ **First initial of surname** *(please write)* _____

If you did not discuss these matters with anyone → (Skip to Question 46)

35	**Did this person seem in favour of energy efficient appliances and heating, or not?**	In favour ☐	Neither in favour, nor not in favour ☐	Not in favour ☐	Don't know ☐		
36	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
37	**Do they live in North Leigh?**	Yes ☐	No ☐	Don't know ☐			

38 Still thinking about energy efficient appliances or heating, who else did you discuss it with since September 2007?

First Name *(please write)* _____ **First initial of surname** *(please write)* _____

If no one else → (Skip to Question 46)

39	**Did this person seem in favour of energy efficient appliances and heating, or not?**	In favour ☐	Neither in favour, nor not in favour ☐	Not in favour ☐	Don't know ☐		
40	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
41	**Do they live in North Leigh?**	Yes ☐	No ☐	Don't know ☐			

42 **Did you discuss energy efficient appliances or heating with anyone else since September 2007?**

First Name *(please write)* _____ **First initial of surname** *(please write)* _____

If no one else → (Skip to Question 46)

		In favour	Neither in favour, nor not in favour	Not in favour	Don't know
43	**Did this person seem in favour of insulation, draught-proofing or changing windows, or not?**	☐	☐	☐	☐

		Immediate family	Wider family	Friend	Neighbour	Colleague	Acquaintance
44	**How do you know them?**	☐	☐	☐	☐	☐	☐

		Yes	No	Don't know
45	**Do they live in North Leigh?**	☐	☐	☐

Section E: The way we act in the house

46 **Thinking back, did you do any of the following in your home before September 2007?**

		Yes	No	Don't Know	Not applicable
a	I switch off items on standby, if possible.	☐	☐	☐	☐
b	I boil the kettle with only just enough water.	☐	☐	☐	☐
c	When it's cold at night, I draw the curtains.	☐	☐	☐	☐
d	I use heating controls (such as timers & valves on radiators).	☐	☐	☐	☐
e	I turn off lights when I leave the house.	☐	☐	☐	☐
f	I turn off electrical equipment (such as computers & attachments) overnight when I don't use them.	☐	☐	☐	☐
g	I shut off heating in rooms that aren't used.	☐	☐	☐	☐

47 **Do you do any of the following in your home now?** Please indicate how often you did each item *in the last 7 days.*

		How often did you do this during the last 7 days?					
		All the time	Most of the time	Half the time	Some of the time	Never	Not applicable
a	I switch off items on standby, if possible.	☐	☐	☐	☐	☐	☐
b	I boil the kettle with only just enough water.	☐	☐	☐	☐	☐	☐
c	When it's cold at night, I draw the curtains.	☐	☐	☐	☐	☐	☐
d	I use heating controls (such as timers & valves on radiators).	☐	☐	☐	☐	☐	☐
e	I turn off lights when I leave the house.	☐	☐	☐	☐	☐	☐
f	I turn off electrical equipment (such as computers & attachments) overnight when I don't use them.	☐	☐	☐	☐	☐	☐
g	I shut off heating in rooms that aren't used.	☐	☐	☐	☐	☐	☐

48 **Thinking of the actions above, who did you discuss it with since September 2007?**

First Name *(please write)* _____ **First initial of surname** *(please write)* _____

If you did not discuss these matters with anyone → (Skip to Section F on page 10)

		In favour	Neither in favour, nor not in favour	Not in favour	Don't know
49	**Did this person seem in favour of changing the way you act to reduce energy use, or not?**	☐	☐	☐	☐

		Immediate family	Wider family	Friend	Neighbour	Colleague	Acquaintance
50	**How do you know them?**	☐	☐	☐	☐	☐	☐

		Yes	No	Don't know
51	**Do they live in North Leigh?**	☐	☐	☐

52 **Still thinking about ways you act in the house, who else did you discuss it with since September 2007?**

First Name *(please write)* _____ **First initial of surname** *(please write)* _____

If no one else → (Skip to Section F on page 10)

		In favour	Neither in favour, nor not in favour	Not in favour	Don't know
53	**Did this person seem in favour of changing the way you act to reduce energy use, or not?**	☐	☐	☐	☐

		Immediate family	Wider family	Friend	Neighbour	Colleague	Acquaintance
54	**How do you know them?**	☐	☐	☐	☐	☐	☐

		Yes	No	Don't know
55	**Do they live in North Leigh?**	☐	☐	☐

56 **Did you discuss energy efficient actions with anyone else since September 2007?**

First Name *(please write)* _____ **First initial of surname** *(please write)* _____

If no one else → (Skip to Section F on page 10)

		In favour	Neither in favour, nor not in favour	Not in favour	Don't know
57	**Did this person seem in favour of insulation, draught-proofing or changing windows, or not?**	☐	☐	☐	☐

		Immediate family	Wider family	Friend	Neighbour	Colleague	Acquaintance
58	**How do you know them?**	☐	☐	☐	☐	☐	☐

		Yes	No	Don't know
59	**Do they live in North Leigh?**	☐	☐	☐

Section F: A bit more about the people you know

I'd now like to ask you a few questions about some of the people you've named in the previous pages. **Please look through the names you have already written and re-write the names of THREE (3) people who you spoke to the MOST about energy efficiency** in the spaces below and answer the questions about them. Please enter a new name on each line. If you spoke to less than three (3) people, simply enter those names you mentioned on the lines below, if any.

First Name	Surname Initial								
_____	____	60	**How old are they?**	Under 25 ☐	25 - 44 years ☐	45-64 years ☐	65-74 years ☐	75+ ☐	Don't know ☐
		61	**Are they male or female?**	Male ☐	Female ☐				
		62	**Are they married or living as a couple?**	Yes ☐	No ☐	Don't know ☐			
		63	**What educational qualification have they achieved?**	Degree level or above ☐	Another kind of qualification ☐	No qualifications ☐	Don't know ☐		
		64	**How old are they?**	Under 25 ☐	25 - 44 years ☐	45-64 years ☐	65-74 years ☐	75+ ☐	Don't know ☐
		65	**Are they male or female?**	Male ☐	Female ☐				
		66	**Are they married or living as a couple?**	Yes ☐	No ☐	Don't know ☐			
		67	**What educational qualification have they achieved?**	Degree level or above ☐	Another kind of qualification ☐	No qualifications ☐	Don't know ☐		
		68	**How old are they?**	Under 25 ☐	25 - 44 years ☐	45-64 years ☐	65-74 years ☐	75+ ☐	Don't know ☐
		69	**Are they male or female?**	Male ☐	Female ☐				
		70	**Are they married or living as a couple?**	Yes ☐	No ☐	Don't know ☐			
		71	**What educational qualification have they achieved?**	Degree level or above ☐	Another kind of qualification ☐	No qualifications ☐	Don't know ☐		

Section G: Just a few more questions about yourself

72 **Does your household own or rent your accommodation?**

- ☐ Owns
- ☐ Rents
- ☐ Lives here rent free

73 **What type of accommodation does your household occupy?** (Tick one option)

A *whole* house or bungalow that is:

- ☐ Detached
- ☐ Semi-detached
- ☐ End-terrace
- ☐ Mid-terrace

A flat, maisonette, or apartment that is:

- ☐ In a purpose-built block of flats or tenement
- ☐ Part of a converted or shared house (includes bedsits)
- ☐ In a commercial building (for example, in an office building, or hotel, or over a shop)

Mobile or temporary structure:

- ☐ A caravan or other mobile or temporary structure

74 **When was your home first built?** If you are not certain, please give your best estimate.

- ☐ Before 1919
- ☐ Between 1919 and 1944
- ☐ Between 1945 and 1964
- ☐ Between 1965 and 1980
- ☐ After 1980
- ☐ Don't know

75 **What is your age?**

- ☐ Under 25 years old
- ☐ 25 - 44 years
- ☐ 45-64 years
- ☐ 65-74 years
- ☐ 75+

76 **What educational qualification have you achieved?**

- ☐ Degree level or above
- ☐ Another kind of qualification or certificate
- ☐ No qualifications or certificates

77 **Does your household include any *couples* either married or living together as partners?**

- ☐ No
- ☐ Yes

78 **Are you male or female?**

- ☐ Male
- ☐ Female

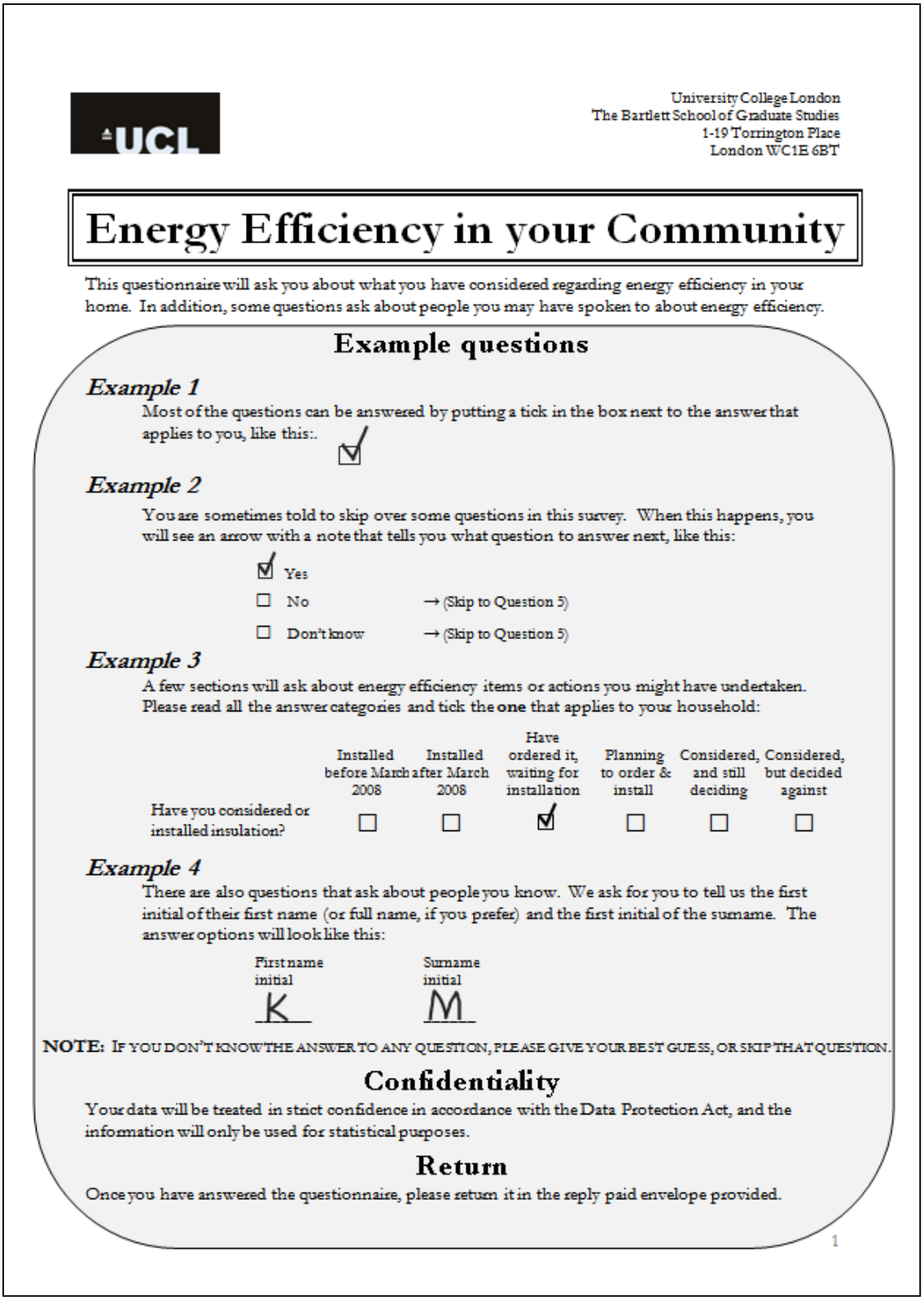
Thank you for taking the time to complete this questionnaire. Your assistance in providing the information is very appreciated. If there is anything else you would like to tell us about, please do so in the place provided below.

Please return your completed questionnaire in the envelope provided to:

Megan McMichael
Doctoral Researcher
University of Reading
School of Construction Management & Engineering
URS Building, PO Box 219
Whiteknights
Reading
RG6 6AW

Pre-test questionnaire – Version 2

The next twelve pages display an example of the second version of the pre-test questionnaire.



UCL

University College London
The Bartlett School of Graduate Studies
1-19 Torrington Place
London WC1E 6BT

Energy Efficiency in your Community

This questionnaire will ask you about what you have considered regarding energy efficiency in your home. In addition, some questions ask about people you may have spoken to about energy efficiency.

Example questions

Example 1

Most of the questions can be answered by putting a tick in the box next to the answer that applies to you, like this:. ☑

Example 2

You are sometimes told to skip over some questions in this survey. When this happens, you will see an arrow with a note that tells you what question to answer next, like this:

☑ Yes
☐ No → (Skip to Question 5)
☐ Don't know → (Skip to Question 5)

Example 3

A few sections will ask about energy efficiency items or actions you might have undertaken. Please read all the answer categories and tick the **one** that applies to your household:

	Installed before March 2008	Installed after March 2008	Have ordered it, waiting for installation	Planning to order & install	Considered, and still deciding	Considered, but decided against
Have you considered or installed insulation?	☐	☐	☑	☐	☐	☐

Example 4

There are also questions that ask about people you know. We ask for you to tell us the first initial of their first name (or full name, if you prefer) and the first initial of the surname. The answer options will look like this:

First name initial: K
Surname initial: M

NOTE: IF YOU DON'T KNOW THE ANSWER TO ANY QUESTION, PLEASE GIVE YOUR BEST GUESS, OR SKIP THAT QUESTION.

Confidentiality

Your data will be treated in strict confidence in accordance with the Data Protection Act, and the information will only be used for statistical purposes.

Return

Once you have answered the questionnaire, please return it in the reply paid envelope provided.

1

Start here

Section A: Household energy use & your community

1 **How long have you lived in Alyth?**

- □ Less than 12 months
- □ 12 months to less than 2 years
- □ 2 years to less than 3 years
- □ 3 years to less than 5 years
- □ 5 years to less than 10 years
- □ 10 years to less than 20 years
- □ 20 years or longer
- □ Don't know

2 **How satisfied or dissatisfied are you with this area as a place to live?**

- □ Very satisfied
- □ Satisfied
- □ Neither satisfied nor dissatisfied
- □ Dissatisfied
- □ Very dissatisfied
- □ Don't know

3 **Would you say you are aware of the 'Alyth Energy Challenge' project which has been running since September 2007?**

- □ Yes
- □ No → (Skip to Question 5)
- □ Don't know → (Skip to Question 5)

4 **Have you had any discussions, or has it come up in conversation, about anything concerning the 'Alyth Energy Challenge' project?**

- □ Yes
- □ No
- □ Don't know

5 **If you had a question about energy use in your home, what would be the FIRST thing you'd do to get information?** Please tick one.

- □ Read newspapers, magazines, journals
- □ Listen to the radio or watch television
- □ Ask someone I know (for example: friend, relative, colleague, acquaintance)
- □ Check sources on the internet
- □ Approach an organisation or group (for example: local council, energy advice centre, energy company)
- □ Don't know

6 The following questions are about **people you personally know right now**.

If you know anyone who fits the question, please tick 'yes' and then say how you know them by ticking the appropriate box under 'How do you know them?' If you do not know anyone who fits the item question, please tick 'no' and go to the next item (a-j).

If you know more than one person who fits each question, that's fine, please tick any box that fits how you know them.

					How do you know them? Please tick as many as apply						
	Do you know anyone who …	No	Yes		Immediate Family	Wider family	Friend	Neighbour	In Alyth but not immediate neighbour	Colleague	Acquaintance
a	… would give you sound advice on energy efficiency?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
b	… would help you find information on energy efficiency?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
c	… would give you sound advice on changing day-to-day activities to help reduce energy use in your home?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
d	… would give you sound advice on real-time energy displays (i.e. smart meters or current cost monitors)?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
e	… would give you sound advice on insulating your house?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
f	… can explain the pros and cons of having a smart meter installed?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
g	… would give you sound advice on energy efficient heating systems?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
h	… would give you sound advice on energy efficient appliances for your kitchen?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
i	… is an electrician or works directly with electrical equipment?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
j	… knows a lot about DIY?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐

Section B: Walls, windows, doors & floors

7 Which of the following have you considered (or purchased or acquired) for the walls, window, doors and floors (or lofts) of your home? Please only tick one box for items *a* through *i*.

		Installed before September 2007	Installed after September 2007	Have ordered it, waiting for installation	Planning to order & install	Considered, and still deciding	Considered, but decided against	Did not consider	Not applicable
a	Cavity wall insulation	☐	☐	☐	☐	☐	☐	☐	☐
b	Solid wall insulation	☐	☐	☐	☐	☐	☐	☐	☐
c	Loft insulation	☐	☐	☐	☐	☐	☐	☐	☐
d	Floor insulation	☐	☐	☐	☐	☐	☐	☐	☐
e	Door draught-proofing	☐	☐	☐	☐	☐	☐	☐	☐
f	Window draught-proofing	☐	☐	☐	☐	☐	☐	☐	☐
g	Heavy curtains for windows or doors to keep heat in	☐	☐	☐	☐	☐	☐	☐	☐
h	Double-glazed windows	☐	☐	☐	☐	☐	☐	☐	☐
i	Secondary-glazed windows	☐	☐	☐	☐	☐	☐	☐	☐

8 From time to time, people discuss matters with others to get information. **Thinking about insulation, draught-proofing or double/secondary glazing of windows, did you discuss these with since anyone September 2007?**

☐ Yes

☐ No → (Skip to Question 12)

☐ Don't know → (Skip to Question 12)

Questions 9-12: Please list up to THREE (3) people with whom you discussed insulation, draught-proofing or windows, filling in the initial of their first name and the initial of surname, and answer the corresponding questions (a, b & c) for each name.

First Person

9 First Name Initial _____ Surname Initial _____ →

a	**Did this person seem in favour of insulation, draught-proofing or changing windows, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐	
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐		

Second Person

10 First Name Initial _____ Surname Initial _____ →

a **Did this person seem in favour of insulation, draught-proofing or changing windows, or not?** In favour ☐ Neutral ☐ Not in favour ☐ Don't know ☐

b **How do you know them?** Immediate family ☐ Wider family ☐ Friend ☐ Neighbour ☐ Colleague ☐ Acquaintance ☐

c **Do they live in Alyth?** Yes ☐ No ☐ Don't know ☐

Third Person

9 First Name Initial _____ Surname Initial _____ →

a **Did this person seem in favour of insulation, draught-proofing or changing windows, or not?** In favour ☐ Neutral ☐ Not in favour ☐ Don't know ☐

b **How do you know them?** Immediate family ☐ Wider family ☐ Friend ☐ Neighbour ☐ Colleague ☐ Acquaintance ☐

c **Do they live in Alyth?** Yes ☐ No ☐ Don't know ☐

Section C: Visual displays of energy use

12 **Which of the following have you purchased, acquired or considered for your home?**

		Is now installed or already did	Already installed, but stopped using	Have ordered it, waiting for installation	Planning to get	Considered and still deciding	Considered but decided against	Did not consider
a	Smart meter	☐	☐	☐	☐	☐	☐	☐
b	Current cost monitor	☐	☐	☐	☐	☐	☐	☐
c	Infrared imaging of your home (to identify heat loss)	☐	n/a	☐	☐	☐	☐	☐

13 **Thinking about smart meters, current cost monitors and infrared (thermal) imaging, did you discuss these with since anyone September 2007?**

☐ Yes

☐ No → (Skip to Question 17)

☐ Don't know → (Skip to Question 17)

Questions 14-16: Please list any THREE (3) people with whom you discussed smart meters, current cost monitors, and infrared imaging, filling in the initial of their first name and the initial of surname, and answer the corresponding questions (a, b & c) for each name.

First Person

14 First Name Initial _____ Surname Initial _____ →

a Did this person seem in favour of smart meters, current cost monitors or thermal infrared imaging, or not?	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b How do you know them?	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c Do they live in Alyth?	Yes ☐	No ☐	Don't know ☐			

Second Person

15 First Name Initial _____ Surname Initial _____ →

a Did this person seem in favour of smart meters, current cost monitors or thermal infrared imaging, or not?	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b How do you know them?	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c Do they live in Alyth?	Yes ☐	No ☐	Don't know ☐			

Third Person

16 First Name Initial _____ Surname Initial _____ →

a Did this person seem in favour of smart meters, current cost monitors or thermal infrared imaging, or not?	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b How do you know them?	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c Do they live in Alyth?	Yes ☐	No ☐	Don't know ☐			

Section D: Appliances and heating

17 Which of the following have you purchased, acquired or considered for your home?

		Installed before September 2007	Installed after September 2007	Have ordered it, waiting for installation	Planning to order	Considered, and still deciding	Considered, but decided against	Did not consider
a	Boiler or heating system upgrade	☐	☐	☐	☐	☐	☐	☐
b	Heating controls for boiler or radiators	☐	☐	☐	☐	☐	☐	☐
c	Radiator reflectors/panels to reflect heat into room	☐	☐	☐	☐	☐	☐	☐
d	'A' rated large appliances (such as: refrigerator, dishwasher, washing machine)	☐	☐	☐	☐	☐	☐	☐

18 Thinking about energy efficient appliances and heating, did you discuss these with since anyone September 2007?

☐ Yes

☐ No → (Skip to Question 22)

☐ Don't know → (Skip to Question 22)

Questions 19-21: Please list any THREE (3) people with whom you discussed appliances and heating, filling in the initial of their first name and the initial of surname, and answer the corresponding questions (a, b & c) for each name.

First Person

19 First Name Initial _____ Surname Initial _____ →

a Did this person seem in favour of energy efficient appliances and heating, or not? In favour ☐ Neutral ☐ Not in favour ☐ Don't know ☐

b How do you know them? Immediate family ☐ Wider family ☐ Friend ☐ Neighbour ☐ Colleague ☐ Acquaintance ☐

c Do they live in Alyth? Yes ☐ No ☐ Don't know ☐

Second Person

20 First Name Initial _____ Surname Initial _____ →

a Did this person seem in favour of energy efficient appliances and heating, or not? In favour ☐ Neutral ☐ Not in favour ☐ Don't know ☐

b How do you know them? Immediate family ☐ Wider family ☐ Friend ☐ Neighbour ☐ Colleague ☐ Acquaintance ☐

c Do they live in Alyth? Yes ☐ No ☐ Don't know ☐

Third Person

21 First Name Initial _____ Surname Initial _____ →

a	**Did this person seem in favour of energy efficient appliances and heating, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐			

Section E: The way we act in the house

22 **Thinking back, did you do any of the following in your home before September 2007?** Please indicate how often you did each item

		How often did you do this before September 2007?					
		All the time	Most of the time	Half the time	Some of the time	Never	Not applicable
a	I switched off items on standby, if possible.	☐	☐	☐	☐	☐	☐
b	I boiled the kettle with only just enough water.	☐	☐	☐	☐	☐	☐
c	When it was cold at night, I drew the curtains.	☐	☐	☐	☐	☐	☐
d	I used heating controls (such as timers & valves on radiators)	☐	☐	☐	☐	☐	☐
e	I turned off lights when they're not needed.	☐	☐	☐	☐	☐	☐
f	I turned off electrical equipment (such as computers & attachments) overnight when it wasn't being used.	☐	☐	☐	☐	☐	☐
g	I shut off heating in rooms that weren't used.	☐	☐	☐	☐	☐	☐

23 **Thinking about energy efficient appliances and heating, did you discuss these with since anyone September 2007?**

☐ Yes

☐ No → (Skip to Question 27)

☐ Don't know → (Skip to Question 27)

Questions 24-26: Please list up to THREE (3) people with whom you discussed these daily activities, filling in their first name and surname initials, and answer the corresponding questions for each name.

First Person

24 First Name Initial _____ Surname Initial _____ →

a Did this person seem in favour of changing the way you do things to reduce energy use, or not?	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b How do you know them?	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c Do they live in Alyth?	Yes ☐	No ☐	Don't know ☐			

Second Person

25 First Name Initial _____ Surname Initial _____ →

a Did this person seem in favour of changing the way you do things to reduce energy use, or not?	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b How do you know them?	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c Do they live in Alyth?	Yes ☐	No ☐	Don't know ☐			

Third Person

26 First Name Initial _____ Surname Initial _____ →

a Did this person seem in favour of changing the way you do things to reduce energy use, or not?	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b How do you know them?	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c Do they live in Alyth?	Yes ☐	No ☐	Don't know ☐			

27 **Do you do any of the following now?** Please indicate how often you did each item *in the last 7 days.*

		How often did you do this during the last 7 days?					
		All the time	Most of the time	Half the time	Some of the time	Never	Not applicable
a	I switched off items on standby, if possible.	☐	☐	☐	☐	☐	☐
b	I boiled the kettle with only just enough water.	☐	☐	☐	☐	☐	☐
c	When it was cold at night, I drew the curtains.	☐	☐	☐	☐	☐	☐
d	I used heating controls (such as timers & valves on radiators)	☐	☐	☐	☐	☐	☐
e	I turned off lights when they weren't needed.	☐	☐	☐	☐	☐	☐
f	I turned off electrical equipment (such as computers & attachments) overnight when it wasn't being used.	☐	☐	☐	☐	☐	☐
g	I shut off heating in rooms that weren't used.	☐	☐	☐	☐	☐	☐

Section F: A bit more about the people you know

I'd now like to ask you a few questions about some of the people you've named in the previous pages. Please look through the initials (or names) you have already written and **re-write the initials of THREE (3) people who you spoke to the MOST about energy efficiency** in the spaces below and answer the questions about them. Please enter a new person on each line. If you spoke to less than three (3) people, simply enter those you mentioned on the lines below, if any.

First Name Initial	Surname Initial								
_____	_____	**28**	**How old are they?**	Under 25 ☐	25 - 44 years ☐	45-64 years ☐	65-74 years ☐	75+ ☐	Don't know ☐
		29	**Are they male or female?**	Male ☐	Female ☐				
		30	**Are they married or living as a couple?**	Yes ☐	No ☐	Don't know ☐			
		31	**What educational qualification have they achieved?**	Degree level or above ☐	Another kind of qualification ☐	No qualifications ☐	Don't know ☐		

First Name Initial	Surname Initial								
_____	_____	**32**	**How old are they?**	Under 25 ☐	25 - 44 years ☐	45-64 years ☐	65-74 years ☐	75+ ☐	Don't know ☐
		33	**Are they male or female?**	Male ☐	Female ☐				
		34	**Are they married or living as a couple?**	Yes ☐	No ☐	Don't know ☐			
		35	**What educational qualification have they achieved?**	Degree level or above ☐	Another kind of qualification ☐	No qualifications ☐	Don't know ☐		

First Name Initial	Surname Initial								
_____	_____	**36**	**How old are they?**	Under 25 ☐	25 - 44 years ☐	45-64 years ☐	65-74 years ☐	75+ ☐	Don't know ☐
		37	**Are they male or female?**	Male ☐	Female ☐				
		38	**Are they married or living as a couple?**	Yes ☐	No ☐	Don't know ☐			
		39	**What educational qualification have they achieved?**	Degree level or above ☐	Another kind of qualification ☐	No qualifications ☐	Don't know ☐		

Section G: Just a few more questions about yourself

40 **Does your household own or rent your accommodation?**

- ☐ Owns outright → (Skip to 42)
- ☐ Owns with a mortgage or loan → (Skip to 42)
- ☐ Pays part rent and part mortgage (shared ownership)
- ☐ Rents
- ☐ Lives here rent free

41 **(If your household pays rent or lives rent free) Who is your landlord?**

- ☐ Council (Local Authority)
- ☐ Housing Association, Housing Co-operative, Charitable Trust or Registered Social Landlord
- ☐ Private landlord or letting agency
- ☐ Employer of a household member
- ☐ Relative or friend of a household member
- ☐ Other

42 **What type of accommodation does your household occupy?** (Tick one option)

A *whole* house or bungalow that is:

- ☐ Detached
- ☐ Semi-detached
- ☐ Terraced (including end-terrace)

A flat, maisonette, or apartment that is:

- ☐ In a purpose-built block of flats or tenement
- ☐ Part of a converted or shared house (includes bedsits)
- ☐ In a commercial building (for example, in an office building, or hotel, or over a shop)

Mobile or temporary structure:

- ☐ A caravan or other mobile or temporary structure

43 **When was your home first built?** If you are not certain, please give your best estimate.

- ☐ Before 1919
- ☐ Between 1919 and 1944
- ☐ Between 1945 and 1964
- ☐ Between 1965 and 1980
- ☐ After 1980
- ☐ Don't know

44 **What is your age?**

- ☐ Under 25 years old
- ☐ 25 - 44 years
- ☐ 45 - 64 years
- ☐ 65 - 74 years
- ☐ 75+

45 **What educational qualification have you achieved?**

- ☐ Degree level or above
- ☐ Another kind of qualification or certificate
- ☐ No qualifications or certificates

46 **Does your household include any *couples* either married or living together as partners?**

- ☐ No
- ☐ Yes

47 **Are you male or female?**

- ☐ Male
- ☐ Female

THANK YOU

Thank you for taking the time to complete this questionnaire. Your assistance in providing the information is very much appreciated. If there is anything else you would like to tell us about, please do so in the place provided below.

Please return your completed questionnaire in the envelope provided to:

Megan McMichael
Doctoral Researcher
University College London
The Bartlett School of Graduate Studies
1-19 Torrington Place
London WC1E 6BT

Summary of pre-test questionnaire findings

Appendix Table 3 summarises the findings from the pre-test questions that were distributed to the members of each local organising group and to professional colleagues.

Appendix Table 3: Pre-test questionnaire feedback

Questionnaire feedback question	Answers
How long did it take you to fill out the questionnaire? Please give approximation, if you didn't time it.	Ranged between 4 minutes and 55 minutes, with an average of 17 minutes
Do you have any reactions to the packaging (i.e. the envelope the questionnaire came in, how things were arranged in the envelope, etc.), either positive or negative? What are those reactions?	Comments included: liked the hand written return envelope with first class postage
Did you notice a letter inside the packet?	Comments included: clear and polite; state more clearly the research will achieve; the community activities are 'projects' not 'campaigns'
Did you read the letter? Was there anything in the letter that you liked or didn't like?	Comments included: fine.
On a scale of 1 to 5, where 1 means very easy and 5 means very difficult, how easy or difficult was it for you to figure out where to begin on the form?	Average 1.3. Comments indicated that the start point could be a bit clearer.
Do you have comments about the format of the questions and the questionnaire?	Comments included: tick boxes are quite small; repetition
Was there any particular section that took longer to fill out? If so, was this because it was more difficult, or hard to remember what was being asked?	Comments included: hard to remember speaking to people; spoke to too many people to include; questionnaire seems longer than it is because of the repetition
Do you have any comments about the wording of questions? Is there anything you didn't understand?	Comments included: sometimes hard to read; found it odd to be asked who they talked to
Did you become bored at any point? If so, which section or question number?	Comments included: No, but is a bit repetitious
Do you think the questionnaire flowed well?	Comments included: mostly yes, though one person said the sections 'slam' into each other
Are there any energy efficiency items (like appliances, electrical equipment, etc) or actions (like closing curtains when it's cold) that you think are missing?	Comments included: Yes – extra clothing; light a fire / wood burning stoves; tumble dryers; level of insulation; keeping doors shut; biomass boilers; low energy bulbs (particularly from Alyth); room thermostat in heating controls
Are there any energy efficiency items (like appliances, electrical equipment, etc) or actions (like closing curtains when it's cold) that you think are included and perhaps shouldn't be? If so, could you please tell me why?	Comments included: Could leave out skirting board insulation
Are there any obvious spelling (or other) mistakes?	Comments included: used 'gotten' in original version
Any other comments?	Comments included: wording in introduction (originally discussed '7 sections') made questionnaire seem long'; one person wrote in 'business acquaintance' for 'how know?'; some people ticked both yes and no boxes, or left blank instead of ticking no; people felt like they had to qualify when they left lights on for security reasons; seven people said it was repetitive; a couple people found asking for names odd and almost intrusive

Summary of changes incorporated into final questionnaire

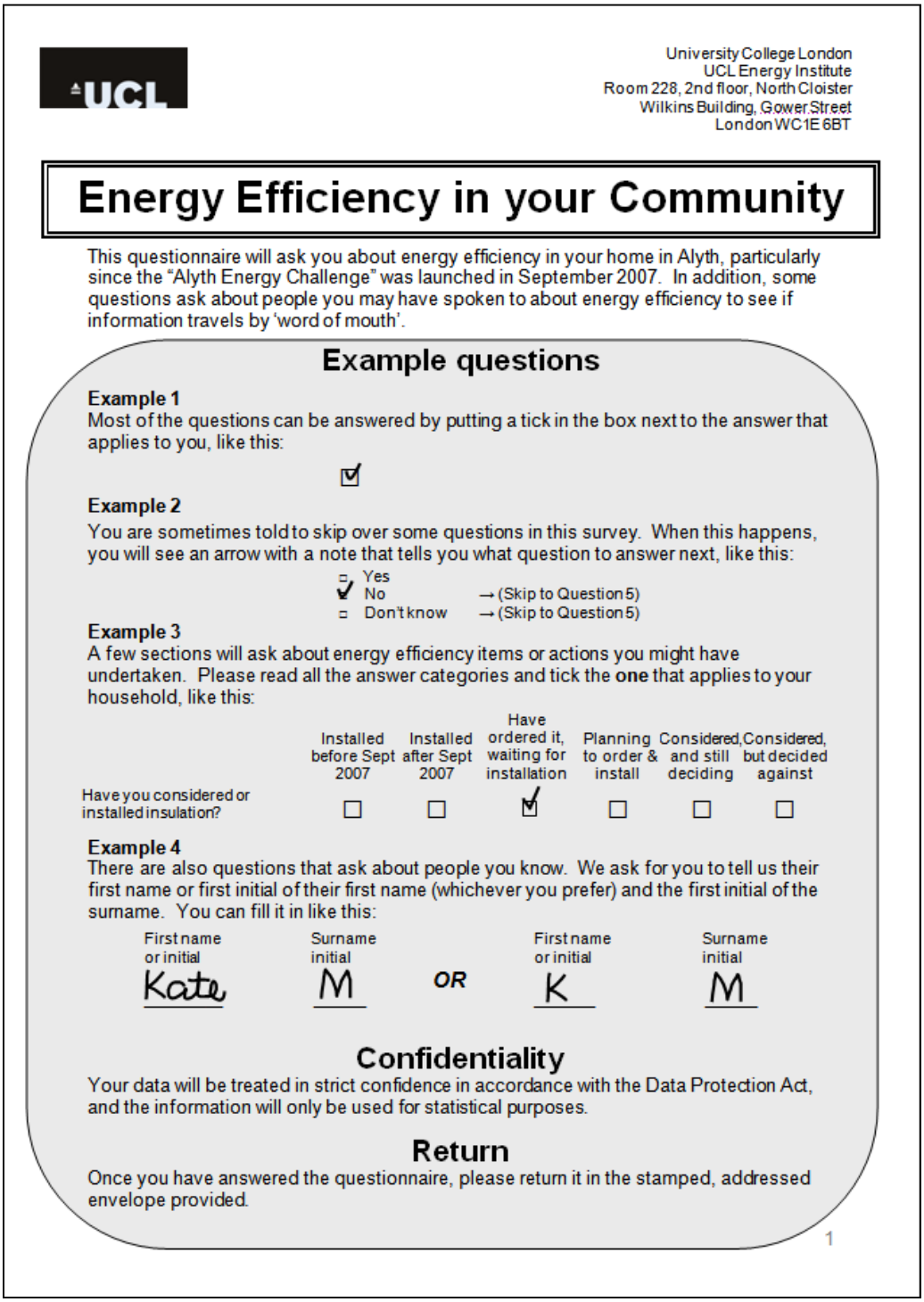
Appendix Table 4 includes changes which were included in the final questionnaire based on the pre-tests and also on the literature review.

Appendix Table 4: Changes made to the final questionnaire based on pre-test feedback & other research

Section of questionnaire	Changes made to questionnaire based on pre-test
General	Font was changed to Arial and slightly increased in size to comply with RNIB recommendations (Hill et al. 2007); Italics were deleted (Madge 2006); slight changes in word order throughout
Cover	Two examples were given for filling in names (instead of one)
Section A: Household energy use & your community	Question 6 was added in response to indications that respondents were already knowledgeable enough themselves on energy efficiency
Section B: Walls, windows, doors & floors	Directions to tick **one** box were put in bold (as shown here), as some people ticked more than one
Section C: Visual displays of energy use	The category 'not applicable' was added to Question 13 asking about visual displays of energy use
Section D: Appliances, heating & lighting	The category 'not applicable' was added to Question 18 asking about appliances, heating and lighting; a category was added that asked about low-energy bulbs
Section E: The way we act in the house	Placed the questions regarding actions in the 'last 7 days' before the questions asking about what was done before the beginning of the interventions; added 'thermostats' to the example in Question 23a
Section F: A bit more about the people you know	'Not applicable' was added to the question asking if the alters were married, as it is possible that an alter could be younger than marrying age, and next to the question about education, as it is possible the alter was not old enough to finish education;
Section G: Just a few more questions about yourself	Changed the education question answer category from 'degree level or above' to 'degree, or degree equivalent, or above'
Back cover	Added the word 'stamped' before envelope, to further indicate that the respondent did not need to pay for postage; changed address and personal title

Appendix D. FINAL VERSION OF THE SELF-COMPLETION QUESTIONNAIRE

The following twelve pages each display the final version of the self-completion questionnaire which was posted to potential respondents in Alyth which were printed to appear on A4 paper in a booklet style (i.e. A3 folded and stapled). The questionnaires for North Leigh and St Athan were very similar, only varying in name, the name of the local organising group or initiative, and the date of the programme start.



University College London
UCL Energy Institute
Room 228, 2nd floor, North Cloister
Wilkins Building, Gower Street
London WC1E 6BT

Energy Efficiency in your Community

This questionnaire will ask you about energy efficiency in your home in Alyth, particularly since the "Alyth Energy Challenge" was launched in September 2007. In addition, some questions ask about people you may have spoken to about energy efficiency to see if information travels by 'word of mouth'.

Example questions

Example 1
Most of the questions can be answered by putting a tick in the box next to the answer that applies to you, like this:

☑

Example 2
You are sometimes told to skip over some questions in this survey. When this happens, you will see an arrow with a note that tells you what question to answer next, like this:

☐ Yes
☑ No → (Skip to Question 5)
☐ Don't know → (Skip to Question 5)

Example 3
A few sections will ask about energy efficiency items or actions you might have undertaken. Please read all the answer categories and tick the **one** that applies to your household, like this:

	Installed before Sept 2007	Installed after Sept 2007	Have ordered it, waiting for installation	Planning to order & install	Considered, and still deciding	Considered, but decided against
Have you considered or installed insulation?	☐	☐	☑	☐	☐	☐

Example 4
There are also questions that ask about people you know. We ask for you to tell us their first name or first initial of their first name (whichever you prefer) and the first initial of the surname. You can fill it in like this:

First name or initial	Surname initial	OR	First name or initial	Surname initial
Kate	M		K	M

Confidentiality

Your data will be treated in strict confidence in accordance with the Data Protection Act, and the information will only be used for statistical purposes.

Return

Once you have answered the questionnaire, please return it in the stamped, addressed envelope provided.

1

Start here

Section A: Household energy use & your community

1 How long have you lived in Alyth?

- ▫ Less than 12 months
- ▫ 12 months to less than 2 years
- ▫ 2 years to less than 3 years
- ▫ 3 years to less than 5 years
- ▫ 5 years to less than 10 years
- ▫ 10 years to less than 20 years
- ▫ 20 years or longer
- ▫ Don't know

2 How satisfied or dissatisfied are you with this area as a place to live?

- ▫ Very satisfied
- ▫ Satisfied
- ▫ Neither satisfied nor dissatisfied
- ▫ Dissatisfied
- ▫ Very dissatisfied
- ▫ Don't know

3 Would you say you are aware of the 'Alyth Energy Challenge' project which has been running since September 2007?

- ▫ Yes
- ▫ No → (Skip to Question 5)
- ▫ Don't know → (Skip to Question 5)

4 Have you discussed or talked about anything concerning the 'Alyth Energy Challenge' project with anyone?

- ▫ Yes
- ▫ No
- ▫ Don't know

5 If you had a question about energy use in your home, what would be the FIRST thing you'd do to get information? Please tick one.

- ▫ Ask someone I know (for example: friend, relative, colleague, acquaintance)
- ▫ Check media sources (for example: the Internet, newspapers, magazines, radio or television)
- ▫ Approach an organisation or group (for example: local council, energy advice centre, energy company)

6 How much, if anything, would you say you know about energy efficiency?

- ▫ A lot
- ▫ A fair amount
- ▫ Just a little
- ▫ Nothing - have only heard of the term
- ▫ Nothing - have never heard of it
- ▫ Don't Know

7 The following questions are about **people you personally know right now**.

If you know anyone who fits the question, please tick 'yes' and then say how you know them by ticking the appropriate box under 'How do you know them?' If you do not know anyone who fits the item question, please tick 'no' and go to the next item.

If you know more than one person who fits each question, that's fine, please tick all boxes that fit how you know them.

					How do you know them? Please tick as many as apply						
	Do you know anyone who ...	No	Yes		Immediate Family	Wider family	Friend	Neighbour	In Alyth but not immediate neighbour	Colleague	Acquaintance
a	... would give you sound advice on energy efficiency?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
b	... would help you find information on energy efficiency?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
c	... would give you sound advice on changing day-to-day activities to help reduce energy use in your home?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
d	... would give you sound advice on how to use your heating system more efficiently?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
e	... would give you sound advice on real-time energy displays (i.e. smart meters or current cost monitors)?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
f	... is an electrician or works directly with electrical equipment?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
g	... would give you sound advice on purchasing energy efficient windows?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
h	... would give you sound advice on insulating your house?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
i	... can explain the pros and cons of having a smart meter installed?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
j	... would give you sound advice on purchasing energy efficient heating systems?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
k	... would give you sound advice on purchasing energy efficient appliances for your kitchen?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐
l	... knows a lot about DIY?	☐	☐	If yes →	☐	☐	☐	☐	☐	☐	☐

Section B: Walls, windows, doors & floors

8 **Which of the following have you considered (or purchased or acquired) for the walls, windows, doors and floors (or lofts) of your home?** Please only tick **one** box for each item *a* through *i*.

		Installed before September 2007	Installed after September 2007	Have ordered it, waiting for installation	Planning to order & install	Considered and still deciding	Considered but decided against	Did not consider	Not applicable
a	Cavity wall insulation	☐	☐	☐	☐	☐	☐	☐	☐
b	Solid wall insulation	☐	☐	☐	☐	☐	☐	☐	☐
c	Loft insulation	☐	☐	☐	☐	☐	☐	☐	☐
d	Floor insulation	☐	☐	☐	☐	☐	☐	☐	☐
e	Door draught-proofing	☐	☐	☐	☐	☐	☐	☐	☐
f	Window draught-proofing	☐	☐	☐	☐	☐	☐	☐	☐
g	Heavy curtains for windows or doors to keep heat in	☐	☐	☐	☐	☐	☐	☐	☐
h	Double-glazed windows	☐	☐	☐	☐	☐	☐	☐	☐
i	Secondary-glazed windows	☐	☐	☐	☐	☐	☐	☐	☐

9 **From time to time, people discuss matters with others to get information.**
Thinking about insulation, draught-proofing or double/secondary glazing of windows, as above, did you discuss these with anyone to get information since September 2007?

☐ Yes
☐ No → (Skip to Question 13)
☐ Don't know → (Skip to Question 13)

Questions 10-12: Please list up to THREE (3) people with whom you discussed insulation, or draught-proofing, or windows to get information since Sept 2007, filling in their first name (or initial) and surname initial, and answer the corresponding questions, ticking only **one** box for each (a, b & c).

First Person

10 First Name or initial _____ Surname Initial _____ →

a	**Did this person seem in favour of insulation, draught-proofing, or changing windows, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐			

Second Person

11 First Name or initial _____ Surname Initial _____ →

a	**Did this person seem in favour of insulation, draught-proofing, or changing windows, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐			

Third Person

12 First Name or initial _____ Surname Initial _____ →

a	**Did this person seem in favour of insulation, draught-proofing, or changing windows, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐			

Section C: Visual displays of energy use

13 Which of the following have you considered, purchased, or acquired for your home?

		Is now installed or already did	Already installed, but stopped using	Have ordered it, waiting for installation	Planning to get	Considered and still deciding	Considered but decided against	Did not consider	Not applicable
a	Smart meter	☐	☐	☐	☐	☐	☐	☐	☐
b	Current cost monitor	☐	☐	☐	☐	☐	☐	☐	☐
c	Infrared thermal imaging of your home (to identify heat loss)	☐	n/a	☐	☐	☐	☐	☐	☐

14 Thinking about smart meters, or current cost monitors, or infrared thermal imaging, did you discuss these with anyone to get information since September 2007?

☐ Yes
☐ No → (Skip to Question 18)
☐ Don't know → (Skip to Question 18)

Questions 15-17: Please list up to THREE (3) people with whom you discussed smart meters, or current cost monitors, or infrared imaging to get information since September 2007, filling in their first name (or initial) and surname initial, and answer the corresponding questions, ticking only **one** box for each (a, b & c).

First Person

15 First Name or initial _____ Surname Initial → _____

a	**Did this person seem in favour of smart meters, current cost monitors, or thermal infrared imaging, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐			

Second Person

16 First Name or initial _____ Surname Initial → _____

a	**Did this person seem in favour of smart meters, current cost monitors, or thermal infrared imaging, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐			

Third Person

17 First Name or initial _____ Surname Initial → _____

a	**Did this person seem in favour of smart meters, current cost monitors, or thermal infrared imaging, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐			

Section D: Appliances, heating & lighting

18 Which of the following have you considered, purchased, or acquired for your home?

		Installed before September 2007	Installed after September 2007	Have ordered it, waiting for installation	Planning to get	Considered and still deciding	Considered but decided against	Did not consider	Not applicable
a	Boiler or heating system upgrade	☐	☐	☐	☐	☐	☐	☐	☐
b	Heating controls for boiler or radiators	☐	☐	☐	☐	☐	☐	☐	☐
c	Radiator reflectors or panels	☐	☐	☐	☐	☐	☐	☐	☐
d	'A' rated large appliances (for example: refrigerator, etc)	☐	☐	☐	☐	☐	☐	☐	☐
e	Low-energy bulbs in most or all light fixtures	☐	☐	☐	☐	☐	☐	☐	☐

19 Thinking about energy efficient appliances, or heating, or lighting, did you discuss these with anyone to get information since September 2007?

☐ Yes

☐ No → (Skip to Question 23)

☐ Don't know → (Skip to Question 23)

Questions 20-22: Please list up to THREE (3) people with whom you discussed appliances, or heating, or lighting to get information since September 2007, filling in their name or initials, and answer the questions, ticking only **one** box for each (a, b & c).

First Person

20 First Name or initial _____ Surname Initial _____ →

a	**Did this person seem in favour of energy efficient heating, lighting, or appliances, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐			

Second Person

21 First Name or initial _____ Surname Initial _____ →

a	**Did this person seem in favour of energy efficient heating, lighting, or appliances, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐			

Third Person

22 First Name or initial _____ Surname Initial → _____

a Did this person seem in favour of energy efficient heating, lighting, or appliances, or not?	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b How do you know them?	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c Do they live in Alyth?	Yes ☐	No ☐	Don't know ☐			

Section E: The way we act in the house

23 **Do you do any of the following now?** Please indicate how often you did each item *in the last 7 days* by ticking **one** box for items a-g.

		How often did you do this during the last 7 days?					
		All the time	Most of the time	Half the time	Some of the time	Never	Not applicable
a	I switched off items on standby, if possible.	☐	☐	☐	☐	☐	☐
b	I boiled the kettle with only just enough water.	☐	☐	☐	☐	☐	☐
c	When it was cold at night, I drew the curtains.	☐	☐	☐	☐	☐	☐
d	I used heating controls (for example: timers & valves on radiators and thermostats).	☐	☐	☐	☐	☐	☐
e	I turned off lights when they were not needed.	☐	☐	☐	☐	☐	☐
f	I turned off electrical equipment (for example: computers) overnight when it wasn't being used.	☐	☐	☐	☐	☐	☐
g	I shut off heating in rooms that weren't used.	☐	☐	☐	☐	☐	☐

24 **Thinking about the actions above in Question 23, did you discuss these with anyone to get information since September 2007?**

☐ Yes

☐ No → (Skip to Question 28)

☐ Don't know → (Skip to Question 28)

Questions 25-27: Please list up to THREE (3) people with whom you discussed the daily activities in Question 23 to get information since September 2007, filling in their first name (or initial) and surname initial, and answer the corresponding questions, ticking only **one** box for each (a, b & c).

First Person

25 First Name or initial _____ Surname Initial _____ →

a	**Did this person seem in favour of changing the way you do things to reduce energy use, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐			

Second Person

26 First Name or initial _____ Surname Initial _____ →

a	**Did this person seem in favour of changing the way you do things to reduce energy use, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐			

Third Person

27 First Name or initial _____ Surname Initial _____ →

a	**Did this person seem in favour of changing the way you do things to reduce energy use, or not?**	In favour ☐	Neutral ☐	Not in favour ☐	Don't know ☐		
b	**How do you know them?**	Immediate family ☐	Wider family ☐	Friend ☐	Neighbour ☐	Colleague ☐	Acquaintance ☐
c	**Do they live in Alyth?**	Yes ☐	No ☐	Don't know ☐			

28 **Thinking back, did you do any of the following in your home *before September 2007*?**

		How often did you do this before September 2007?					
		All the time	Most of the time	Half the time	Some of the time	Never	Not applicable
a	I switched off items on standby, if possible.	☐	☐	☐	☐	☐	☐
b	I boiled the kettle with only just enough water.	☐	☐	☐	☐	☐	☐
c	When it was cold at night, I drew the curtains.	☐	☐	☐	☐	☐	☐
d	I used heating controls (for example: timers & valves on radiators and thermostats).	☐	☐	☐	☐	☐	☐
e	I turned off lights when they were not needed.	☐	☐	☐	☐	☐	☐
f	I turned off electrical equipment (for example: computers) overnight when it wasn't being used.	☐	☐	☐	☐	☐	☐
g	I shut off heating in rooms that weren't used.	☐	☐	☐	☐	☐	☐

Section F: A bit more about the people you know

I'd now like to ask you a few questions about some of the people you've named in the previous pages. Please look through the initials (or names) you have already written & **re-write the initials of THREE (3) people who you spoke to the MOST about energy efficiency** in the spaces below and answer the questions about them. Please enter a new person on each line. If you spoke to less than three (3) people, simply enter those you mentioned on the lines below, if any.

First Name or initial	Surname Initial									
_____	_____	29	**How old are they?**	Under 16 years ☐	16-24 years ☐	25-44 years ☐	45-64 years ☐	65-74 years ☐	75+ ☐	Don't know ☐
		30	**Are they male or female?**	Male ☐	Female ☐					
		31	**Are they married (or living as a couple)?**	Yes ☐	No ☐	Don't know ☐	Not applicable ☐			
		32	**What educational qualification have they achieved?**	Degree, or equivalent, or above ☐	Another kind of qualification ☐	No qualifications ☐	Don't know ☐	Not applicable ☐		

First Name or initial	Surname Initial									
_____	_____	33	**How old are they?**	Under 16 years ☐	16-24 years ☐	25-44 years ☐	45-64 years ☐	65-74 years ☐	75+ ☐	Don't know ☐
		34	**Are they male or female?**	Male ☐	Female ☐					
		35	**Are they married (or living as a couple)?**	Yes ☐	No ☐	Don't know ☐	Not applicable ☐			
		36	**What educational qualification have they achieved?**	Degree, or equivalent, or above ☐	Another kind of qualification ☐	No qualifications ☐	Don't know ☐	Not applicable ☐		

First Name or initial	Surname Initial									
_____	_____	37	**How old are they?**	Under 16 years ☐	16-24 years ☐	25-44 years ☐	45-64 years ☐	65-74 years ☐	75+ ☐	Don't know ☐
		38	**Are they male or female?**	Male ☐	Female ☐					
		39	**Are they married (or living as a couple)?**	Yes ☐	No ☐	Don't know ☐	Not applicable ☐			
		40	**What educational qualification have they achieved?**	Degree, or equivalent, or above ☐	Another kind of qualification ☐	No qualifications ☐	Don't know ☐	Not applicable ☐		

Section G: Just a few more questions about yourself

41 Does your household own or rent your accommodation?

- ▫ Owns outright → (Skip to 43)
- ▫ Owns with a mortgage or loan → (Skip to 43)
- ▫ Pays part rent and part mortgage (shared ownership)
- ▫ Rents
- ▫ Lives here rent free

42 (If your household pays rent or lives rent free) Who is your landlord?

- ▫ Council (Local Authority)
- ▫ Housing Association, Housing Co-operative, Charitable Trust or Registered Social Landlord
- ▫ Private landlord or letting agency
- ▫ Employer of a household member
- ▫ Relative or friend of a household member
- ▫ Other

43 What type of accommodation does your household occupy? (Tick one option)

A *whole* house or bungalow that is:

- ▫ Detached
- ▫ Semi-detached
- ▫ Terraced (including end-terrace)

A flat, maisonette, or apartment that is:

- ▫ In a purpose-built block of flats or tenement
- ▫ Part of a converted or shared house (includes bedsits)
- ▫ In a commercial building (for example: in an office building, or hotel, or over a shop)

Mobile or temporary structure:

- ▫ A caravan or other mobile or temporary structure

44 When was your home first built? If you are not certain, please give your best estimate.

- ▫ Before 1919
- ▫ Between 1919 and 1944
- ▫ Between 1945 and 1964
- ▫ Between 1965 and 1984
- ▫ 1985 or later
- ▫ Don't know

45 What is your age?

- ▫ 16 - 24 years
- ▫ 25 - 44 years
- ▫ 45 - 64 years
- ▫ 65 - 74 years
- ▫ 75+

46 What educational qualification have you achieved?

- ▫ Degree, or degree equivalent, or above
- ▫ Another kind of qualification
- ▫ No qualifications

47 Does your household include any *couples* either married or living together as partners?

- ▫ No
- ▫ Yes

48 Are you male or female?

- ▫ Male
- ▫ Female

Thank you

Thank you for taking the time to complete this questionnaire. Your assistance in providing the information is very much appreciated. If there is anything else you would like to tell me about, please do so in the place provided below.

Please return your completed questionnaire in the stamped, addressed envelope provided.

Megan McMichael
PhD Student
University College London, UCL Energy Institute
Room 228, 2nd floor, North Cloister
Wilkins Building, Gower Street
London WC1E 6BT

Appendix E. SURVEY DESIGN, CONTENT AND IMPLEMENTATION

Questionnaire design

The questions were placed on ten A4 pages. Dillman (2000) and Beebe et al. (2007) recommend using smaller page sizes,[207] but A4 paper size was convenient and would not reduce readability. It was decided to print on A3 paper and fold them to make a booklet of twelve pages (Beebe et al. 2007; Dillman 2000), leaving room for instructions on the front cover and space for respondent feedback on the back cover (Dillman 2000). Twelve pages is the upper-end of the acceptable length of household questionnaire (i.e. from 4 to 12 pages) (Czaja & Blair 2005). The thickness of the paper has not been demonstrated to have an effect on response rates, but thicker paper has been associated with higher completion rates (Mallen et al. 2008). Therefore a 100gsm paper was chosen over an 80gsm paper for the original questionnaire distribution.[208] Arial font was used, as it is more readable, particularly by those with eyesight problems (Mallen et al. 2008; Hill 2007). Hill (2007) also indicated that Arial is recommended by the Royal National Institute for the Blind in at least a 12pt font size. Most of the questions were typed in 12pt font, but to keep the questionnaire length to a maximum of twelve pages, some fonts were smaller (the smallest was Arial 9pt). As Madge (2006) recommended, bold fonts were used sparingly, only to indicate questions (Dillman 2000), and italics were only used once in the final questionnaire.

As Dillman (2000) indicates, more research is needed on the efficacy of a cover page, but it does need to be "immediately distinguishable from all other questionnaires that a respondent might receive" as it creates a first impression (p.137). The number of pages of the folded questionnaire allowed for a front cover, which was used as an introductory page. The graphical design was kept simple and neutral (Dillman 2000), only using black and white colours, and given an easy identifiable title at the top: "Energy Efficiency in your Community". Based on the Carbon Reduction in Buildings (CaRB) Home Energy Survey 2007 (Shipworth et al. 2010), the front page also included a brief explanation of the survey (i.e. two sentences), and example questions. The name and address of the university was also included on the front cover, to enable ease of return if the return envelope is lost (Dillman 2000). The back cover was kept simple, including

[207] Smaller meaning 6 1/8 x 8 1/4 inches (instead of the standard 8 1/2 by 11 inch American size paper) (Beebe et al. 2007)
[208] An administrative error meant that the follow-up surveys were printed on 80gsm paper.

only a word of thanks, a large space for any comments (Dillman 2000) and the return address. A statement of confidentiality was included on the front cover as an ethical consideration (see section 7.6), as well as a statement explaining that an envelope was enclosed for the return of the questionnaire.

For the content of the middle ten pages of the questionnaire, certain methods were followed that have been subject to empirical tests (de Vaus 2002). The first page following the front cover began by telling the respondent where to start, with the words 'start here' and an arrow pointing to the first question (Dillman 2000). Instructions were placed just before each question, in addition to the examples that were given on the front cover (Dillman 2000). The appearance was made as consistent as possible throughout. Questions were numbered sequentially and if there were sub-questions or subsections, letters were used instead of numbers (Dillman 2000). Questions were darker, i.e. bold, and answer categories were lighter, i.e. not bold (Dillman 2000). Tick boxes for questions were lined vertically, where possible (Dillman 2000; de Vaus 2002). For certain questions in the energy efficiency resource generator and sections asking about innovations, tick boxes were aligned horizontally, to save space, and ordered in an item-in-a-series format (Dillman 2000). If skip patterns were present (i.e. respondents could skip a question if it did not pertain to them), they were labelled with an arrow clearly and told which question was next after the skip (Dillman 2000). Questions that related to each other were grouped into sections (de Vaus 2002). All personal questions relating the respondent's age, educational qualifications, marital status and gender were placed at the end of the survey (de Vaus 2002).

It is recommended that surveys be maintained at a Flesch-Kincaid scale of about 6, which equates to an American 6th grade level, or about 12 years old (Campanelli 2008b). This scale is available in Microsoft Word. When checked in Word 2007, the final questionnaire had a score of 7, which means that the readability is at a 13 year old level.

Questionnaire content

This section indicates how the questionnaire content of the data not directly related to the research hypotheses, though used in data analysis, was constructed. Appendix Table 5 summarises the insertions that are made in the questions below. For example, when the question says 'name of village/town', the questionnaires sent to North Leigh had 'North Leigh' stated at that point.

Appendix Table 5: Unique identifiers for each questionnaire, i.e. the text inserted into questions

Community	[Name of village / town]	[Name of local programme]	[Date programme started]
North Leigh	North Leigh	Challenge North Leigh	September 2007
St Athan	St Athan	Get Smart with St Athan	March 2008
Alyth	Alyth	Alyth Energy Challenge	September 2007

Introductory questions

The questionnaire begins on page 2 with a section titled "Household energy use & your community" and contains six initial questions that first address issues surrounding the community, then awareness of the energy efficiency intervention, and finally energy efficiency knowledge. The first question in any questionnaire should apply to everyone (Dillman 2000) and should be interesting and easy to answer (Dillman 2000; de Vaus 2002). It should also show a "connectedness" between the respondent and the survey (Dillman 2000, p.94). Therefore, a fairly simple introductory question was formulated:

1 How long have you lived in [name of village / town]?

This first question, in addition to the second question, were both recommended questions from the set of "Harmonised Concepts and Questions for Social Data Sources - Secondary Standards: Social Capital" from the Office of National Statistics (ONS 2008c). Though the ONS adheres more to the collective-level definition of social capital (see Harper 2001; Babb 2005; McMichael 2007), these questions made suitable opening questions.

There were eight answer categories which were the same categories of the ONS question (ONS 2008c). [209] Asking about the community sets the context for the questionnaire, which has a focus on the respondents' geographic community. In addition, it is a rather unobtrusive question to put the respondent at ease and gain initial trust. The ease of answering this question is evidenced by a 97% response rate in North Leigh, 95% in St Athan and 98% in Alyth. The second question was:

2 How satisfied or dissatisfied are you with this area as a place to live?[210]

[209] "Less than 12 months; 12 months but less than 2 years; 2 years but less than 3 years; 3 years but less than 5 years; 5 years but less than 10 years; 10 years but less than 20 years; 20 years or longer; Don't know" (ONS 2008c, p.5).

[210] The ONS question (ONS 2008c) actually is stated: "How satisfied are you with this area as a place to live?" (p.5), however, it was felt that only stating the 'satisfied' answer category might bias results, so the 'dissatisfied' was added, as these answer categories were also available.

Answer categories included very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, very dissatisfied and don't know. Response rates were 98% in North Leigh, 90% in St Athan and 99% in Alyth.

The next two questions were specifically designed to elicit information on awareness of the local programme supporting energy efficiency, as well as interpersonal communication on the issues of the programme.

3 Would you say you are aware of the [name of local programme] project which has been running since [date programme started]?

4 Have you discussed or talked about anything concerning the [name of local programme] project with anyone?

Question 3 has answer categories of yes, no and don't know.[211] This question tests awareness of the programme, similar to Weenig & Midden (1991) and Weenig (1993), both of which operationalised 'information diffusion' on energy efficiency programmes by asking about a variety of questions on awareness of energy efficiency programmes which were assessed in terms of information received through social networks. Both found that information diffusion (awareness) was related to the number of communication ties, and also to weak ties (Weenig 1993). Question 3 also reminds or informs the respondent of the energy efficiency initiative in their community. This reminder is an opportunity to indicate a time-frame, which is consistent throughout the questionnaire. "Knowledge" is also the first step in the innovation-diffusion process. Knowledge of energy efficiency - or household energy use in general - is what is actually being tested in the research questions and hypotheses here, rather than knowledge of the community programme. However, information on energy efficiency has been in the general media for several years before the programmes began in each village began. As the SSE interventions are more concentrated than national campaigns, the knowledge of the programme may indicate a heightened awareness of energy-reducing innovations in general.

Question 4 is meant to instigate recall of both the project and all related conversations, which sets a context for later questions asking for specific people with whom respondents have talked. The answer categories for Question 4 are the same as for Question 3.

The final questions on the first page of the questionnaire asks:

[211] There is a skip pattern after Question 3, if the respondent answers 'no' or 'don't know', where the respondent is directed to Question 5.

6 How much, if anything, would you say you know about energy efficiency?

□ A lot
□ A fair amount
□ Just a little
□ Nothing - have only heard of the term
□ Nothing - have never heard of it
□ Don't know

This question is based on similar questions in the Defra *Survey of Public Attitudes and Behaviours toward the Environment: 2007* (Defra 2007b) which asked: "How much, if anything, would you say you know about the following terms? (Climate change, etc.)." The Defra survey was carried out in a face-to-face interview, with answer choices read out in random order. Question 6 was added to the 'Energy Efficiency in your Community' questionnaire here in response to the pre-test (see section 7.2.3 and Appendix C). The pre-test respondents are not necessarily representative of the populations, but several made comments about being the person that *others* would ask for advice. This prompted consideration of respondents' beliefs of their own knowledge levels.

Accommodation

Four questions were placed on the last page of the questionnaire which focused on the household accommodation. The first two questions asked about tenure, with answer categories based on the ONS (2005) questions and output categories. The first question asked if the household owned or rented the accommodation.

41 Does your household own or rent your accommodation?

□ Owns outright → (Skip to 43)
□ Owns with a mortgage or loan → (Skip to 43)
□ Pays part rent and part mortgage (shared ownership)
□ Rents
□ Lives here rent free

If a person did not own their accommodation, they were asked to indicate who their landlord is in second question, and answer categories were provided according to the ONS (2005).

42 (If your household pays rent or lives rent free) Who is your landlord?

□ Council (Local Authority)
□ Housing Association, Housing Co-operative, Charitable Trust or Registered Social Landlord
□ Private landlord or letting agency
□ Employer of a household member
□ Relative or friend of a household member
□ Other

The third question was based on the *Harmonised Concepts and Questions for Social Data: Sources Secondary - Standards Accommodation and Household Information* (ONS 2008b), and was phrased as such:

43 **What type of accommodation does your household occupy?** (Tick one option)
A *whole* house or bungalow that is:
□ Detached
□ Semi-detached
□ Terraced (including end-terrace)
A flat, maisonette, or apartment that is:
□ In a purpose-built block of flats or tenement
□ Part of a converted or shared house (includes bedsits)
□ In a commercial building (for example: in an office building, or hotel, or over a shop)
Mobile or temporary structure:
□ A caravan or other mobile or temporary structure

The question wording for type of accommodation is derived from the UK Census 2001 (National Statistics 2001). The final question asked when the home was first built, and the answer categories were based on the General Household Survey (ONS 2002):

44 **When was your home first built?** If you are not certain, please give your best estimate.
□ Before 1919
□ Between 1919 and 1944
□ Between 1945 and 1964
□ Between 1965 and 1984
□ 1985 or later
□ Don't know

Although there are discrepancies in variables regarding household age, particularly between some Government surveys (including the GHS) and those used for ascertaining SAP ratings (Summerfield et al. 2006), the former was chosen as it had fewer answer categories, which would alleviate the difficulty in answering a question that might not be exactly known by the respondent. Further, the purpose was not to compare to building regulation implementations, which is often a reason for refining answer categories of building age (Summerfield et al. 2006).

Tailored Design

The Total Design Method (TDM) was developed by Don Dillman in 1972 (Dillman 1991). Tailored Design was subsequently developed by Dillman (2000), which refines the original TDM, accounting for "new technologies, theoretical advancements, mixed-mode considerations, a better understanding of specific survey requirements, and an improved base of social science knowledge" (Dillman 2000, p.6). The aim of TDM and the Tailored Design are to reduce four types of survey error, namely sampling error,

coverage error, measurement error and, most importantly, nonresponse error. Prior to the 1970s, self-completion surveys were not considered reliable instruments by the social research community, due to the extremely low response rates, which led to unrepresentative samples and large questions around validity and reliability (Dillman 1991). Extensive research began in the 1970s to understand nonresponse of surveys and the TDM was based on this research. Dillman (1991) states that:

> "The theoretical framework used in this approach posits that questionnaire recipients are most likely to respond if they expect that the perceived benefits of doing so will outweigh the perceived costs of responding" (p.233).

Attention must be given to the details of questionnaire design and administration in order for recipients to believe that costs (e.g. of time and postage) are low, and that benefits (e.g. sense of accomplishment achieved through feelings of contributing to research) are high. Questionnaire design was discussed in Chapter 7 and above. Regarding administration, the main actions of the TDM include multiple points of contact with the potential recipients and inclusion of an incentive. The next five sections explain these elements and describe the actions taken in the research presented here.

First point of contact: Pre-notice letter

The first point of contact that a potential respondent should have from the researcher, according to the Total Design Method (TDM), is a brief pre-notice letter. "The purpose of a pre-notice letter is to provide a positive and timely notice that the recipient will be receiving a request to help with an important study or survey" (Dillman 2000, p.156). It is recommended to use a personally signed letter, rather than a postcard, as it is less likely to be quickly discarded. The letter is meant to convey the importance of the survey, establish legitimacy, and invoke trust. It is sent a few days ahead of the actual questionnaire.

The pre-notice letters used for the research here were kept to one side of an A4 page, and signed with a blue pen to make it obvious that it was not an electronic signature (Dillman 2000). The text was brief (about 200 words long) and a postscript was added, as recommended in the TDM, indicating that an incentive would be included in the questionnaire. In addition, a tri-fold leaflet was created and included in this mailing. This leaflet included a brief explanation of the questionnaire, information regarding the funders, an indication of why it was important that the potential respondent reply, a notice about who would receive the results, and a statement of confidentiality. The researchers contact details and a black-and-white picture of the researcher were also included. The leaflet was printed on coloured paper to distinguish it from the letter. The

letter and leaflet were inserted into an envelope,[212] and a stamp was affixed, to avoid bulk postage stamping (de Vaus 2001), and a return address affixed to the back of the envelope.

Approximately 1,450 preletters were sent in total, i.e. to the complete sampling frame of all three communities.[213] The preletters were sent 6 days in advance in North Leigh and St Athan and 7 days in advance in Alyth.[214] A return address was stated on the back of the envelope; if any were returned due to wrong addressee, they were omitted from future mailings.

Second point of contact: Questionnaire

The second point of contact is the point at which the questionnaire is first posted to the potential respondent. The mailing should include a cover letter, the questionnaire itself, a self-addressed stamped return envelope, and an optional incentive (Dillman 2000).

According to the TDM, the cover letters were printed on one side of an A4 sheet paper.[215] The letters were addressed to the recipient, and the salutation included the person's name (Dillman 2000). The letter contained information on the questionnaire, an explanation was made of the importance of the completion of the questionnaire, and a statement of confidentiality was included (Dillman 2000). The letters were signed by the researcher in blue ink (Dillman 2000). The A4 size, 12-page questionnaires were printed on A3 paper by the university print shop, stapled in the middle, and folded. The return envelope was a brown C5 envelope which had the researcher's addressed printed on it, with a first class stamp affixed. A postcard was also included, asking the recipient if he or she would be willing to take part in future research (for qualitative research recruitment, see Chapter 7). Finally, an incentive of a book of 6 first class UK stamps was included. The use of an incentive is meant to increase response rates by between 3% to 30% (Jobber et al. 2004). The use of an incentive provokes controversy (Dillman 2000), as it has been hypothesised that it may introduce respondent bias (Teisl et al. 2006). However, it is fairly standard in national UK surveys (Simmons & Wilmot 2004). Cash incentives of perhaps £5 (Moody 2008) have been found to be the most effective (Dillman 2000; Brennan & Charbonneau 2009), but there are also ethical

[212] A size 110mm x 220mm envelope.
[213] Some names were excluded from the complete sampling frame list. One reason for exclusion was if either there was doubt of the name and address due to inconsistencies in importing the information from its original data format. Another reason is that the names of those who completed the pretest were checked against the final sampling frame; if they were in the sampling frame, they were omitted in order to present unbiased results.
[214] The Alyth survey implementation was delayed by two months to avoid conflicting with a survey that the local energy efficiency group was sending at the same time.
[215] 80gsm white recycled paper

issues with sending money to potential respondents (Moody 2008). Reviewing literature of those using a book of six first-class UK stamps as an incentive, Simmons & Wilmot (2004) found that response rates increased by 3-5% (Simmons & Wilmot 2004). Qualitative evidence indicated that respondents appreciated the stamps and felt more compelled to at least read the letter and questionnaire (Simmons & Wilmot 2004). In addition, the use of stamps as an incentive has been used in six different national surveys funded by the UK Government (Simmons & Wilmot 2004).[216]

Dillman (2000) indicates that the contents should be folded so that the recipient takes everything out at the same time and can see everything at once. Thus, the cover letter and questionnaire were folded together and the postcard, return envelope and book of stamps were placed inside these folded materials and placed in a size C5 envelope.

Third point of contact: thank you and reminder

At this point, conventional wisdom may lead a researcher to simply wait for the responses of the questionnaire. Dillman (2000), however, indicates that multiple points of contact, particularly with those who do not respond, increases response rates by between 20-40%. He recommends using a third point of contact of a follow-up thank / reminder postcard approximately 2 weeks later. He indicates this is not necessarily overcoming resistance, but simply bringing the survey back to the minds of the recipients. The postcard should remind the recipient when the questionnaire was sent, thank the person if they have already returned it, and remind those who have not responded of the appreciation the researcher would have if the recipient did so (Dillman 2000). An offer is also made to replace the questionnaire (Dillman 2000).

Accordingly, a postcard was sent to every recipient to whom a preletter and questionnaire was sent (omitting those with a wrong address or who requested not to be contacted again). If the questionnaire was received, the reminder sentence was crossed out. All postcards were signed by hand in blue ink. In North Leigh and St Athan, the postcards were sent 10 days after the questionnaires; in Alyth, they were sent 9 days later.

Fourth point of contact: replacement questionnaire

The fourth point of contact is a replacement questionnaire to nonrespondents, which Dillman (2000) recommends sending approximately four weeks after the second point of contact (i.e. the initial questionnaire mailout). In this case, the content of the cover

[216] The surveys are: "The Omnibus Survey, Family Resources Survey, Expenditure and Food Survey and General Household Survey" (Simmons & Wilmot 2004, p.1).

letter has a “tone of insistence” (Dillman 2000, p.181), indicating that the researcher has not heard from the recipient yet, stating that others have responded and again emphasising the importance of the respondents’ answers.

This fourth point of contact again included a cover letter, worded slightly differently than the initial questionnaire’s cover letter, though the tone was not as insistent as Dillman’s (2000) example (see Dillman 2000, p.182). A questionnaire was again included, though an administrative error meant that these second prints were on thinner paper (80gsm) than the first questionnaires (100gsm). A return envelope was again included, but there was no postcard (asking if the participant would be willing to take part in further research) or incentive included. This fourth contact was sent 18 days after the reminder / thank you postcard (and exactly 4 weeks after the initial questionnaire) in North Leigh and St Athan and 19 days after the postcard in Alyth (again, exactly 4 weeks after the initial questionnaire).

Fifth point of contact: special procedures

Dillman (2000) recommends using a slightly different method for the fifth point of contact. It should again include a questionnaire, but should be either sent by certified mail or telephone contact should be made. Telephone follow-up can be very difficult if the telephone numbers are unknown, but “the effectiveness of certified mail has been shown to be substantial” (Dillman 2000, p.184), which he recommends posting approximately eight weeks after the initial questionnaire. However, due to the high costs of a fifth point of contact, and in an effort to avoid irritating recipients, it was decided to omit the fifth point of contact for the survey implementation here.

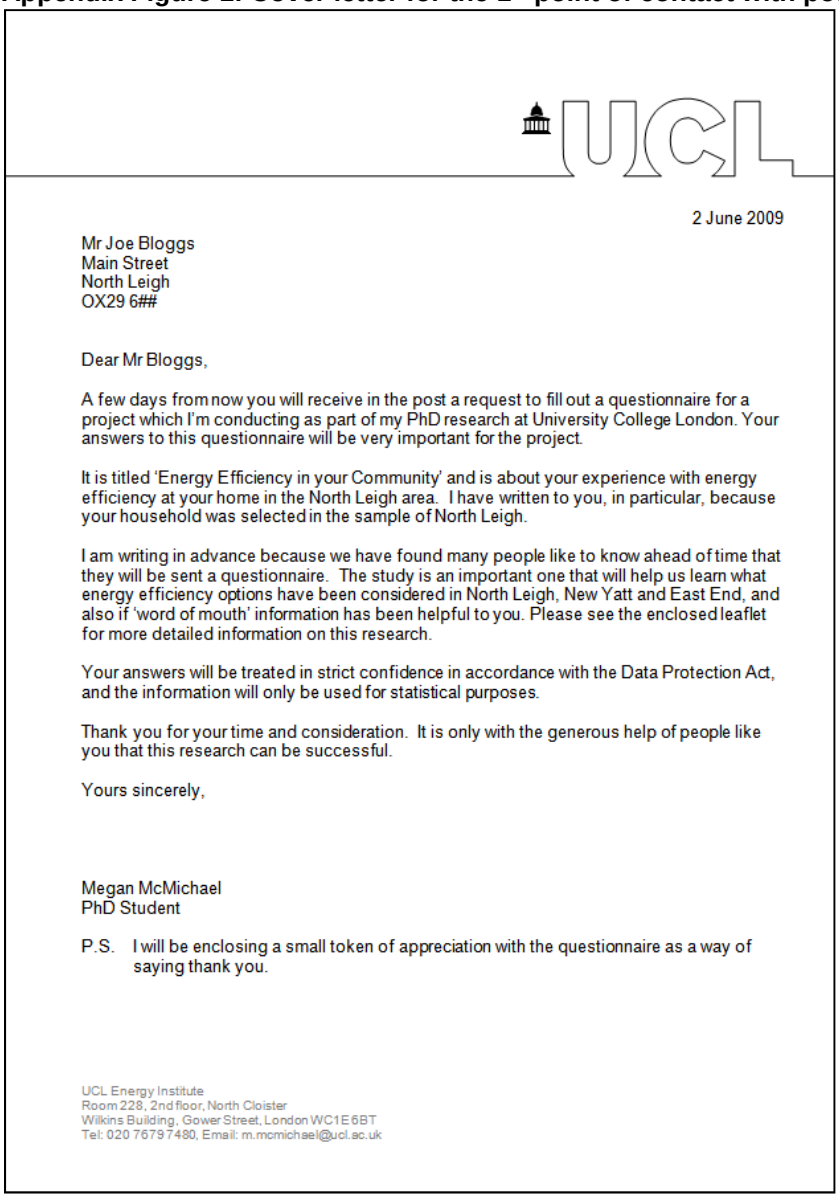
Appendix F. CONTENTS OF MAILING IN THE FOUR POINTS OF CONTACT

This appendix includes the contents of all four points of contact that the author had with potential respondents.

1st point of contact mailing contents

The first point of contact, according to the Tailored Design Method, is meant to inform the recipient that he or she will be receiving a questionnaire. A cover letter was thus constructed (Appendix Figure 1), as was a tri-fold pamphlet (Appendix Figure 2 and Appendix Figure 3) to give further information.

Appendix Figure 1: Cover letter for the 1st point of contact with potential respondents



UCL

2 June 2009

Mr Joe Bloggs
Main Street
North Leigh
OX29 6##

Dear Mr Bloggs,

A few days from now you will receive in the post a request to fill out a questionnaire for a project which I'm conducting as part of my PhD research at University College London. Your answers to this questionnaire will be very important for the project.

It is titled 'Energy Efficiency in your Community' and is about your experience with energy efficiency at your home in the North Leigh area. I have written to you, in particular, because your household was selected in the sample of North Leigh.

I am writing in advance because we have found many people like to know ahead of time that they will be sent a questionnaire. The study is an important one that will help us learn what energy efficiency options have been considered in North Leigh, New Yatt and East End, and also if 'word of mouth' information has been helpful to you. Please see the enclosed leaflet for more detailed information on this research.

Your answers will be treated in strict confidence in accordance with the Data Protection Act, and the information will only be used for statistical purposes.

Thank you for your time and consideration. It is only with the generous help of people like you that this research can be successful.

Yours sincerely,

Megan McMichael
PhD Student

P.S. I will be enclosing a small token of appreciation with the questionnaire as a way of saying thank you.

UCL Energy Institute
Room 228, 2nd floor, North Cloister
Wilkins Building, Gower Street, London WC1E 6BT
Tel: 020 7679 7480, Email: m.mcmichael@ucl.ac.uk

Appendix Figure 2: Information pamphlet included in the 1st point of contact (front)

Thank you!

You will receive the questionnaire *Energy Efficiency in your Community* in the next few days. If you have any questions, please contact me.

UCL

Contact details:

Megan McMichael
PhD Student

University College London
UCL Energy Institute
Room 228, 2nd floor, North Cloister
Wilkins Building, Gower Street
London WC1E 6BT

Email: m.mcmichael@ucl.ac.uk
Tel: 0207 679 7480

This project has been subject to ethical review by University College London, and has been allowed to proceed.

UCL

University College London
UCL Energy Institute
Room 228, 2nd floor, North Cloister
Wilkins Building, Gower Street
London WC1E 6BT

Energy Efficiency in your Community Survey

Appendix Figure 3: Information pamphlet included in the 1st point of contact (back)

What is the *Energy Efficiency in your Community* Survey?

The *Energy Efficiency in your Community* survey is a questionnaire which you will receive in the post in the next few days. The aim of this survey is to assess what energy efficiency devices or actions people in your community might have done, or considered, in their home. I am also interested in knowing if information is available or spread through 'word of mouth'.

Your answers will help us understand more about which factors influence energy use. This could ultimately help increase options for reducing household energy costs and address the issues of climate change.

Who is funding the research?

My PhD research project is funded by CaRB (Carbon Reduction in Buildings), which is a consortium of five UK universities:

- University College London
- University of Reading
- De Montfort University
- University of Manchester
- University of Sheffield

CaRB is supported by the Carbon Vision initiative, funded by the Carbon Trust and the Engineering and Physical Sciences Research Council, with additional support from the Economic and Social Research Council.

Why do we need you?

This research is specifically aimed at three communities in the UK, including yours. Only by getting answers from you will we gain an accurate picture of what is happening in your community regarding energy efficiency.

We have written to you, in particular, because your household was selected in the sample of your community. Only by receiving your questionnaire, combined with information from other participants, will I be able to better understand what may influence the uptake of certain energy efficiency measures in your community.

Who will use the results?

The final results will combine the answers from all participants in your area to give a picture of energy efficiency and information in your community.

These results will summarised in a report specifically for your community. This report will be available in the autumn of 2009 and you can contact me at that time for a copy.

The anonymised results will also be used in reports and may be able to influence local and national energy efficiency policies.

Confidentiality

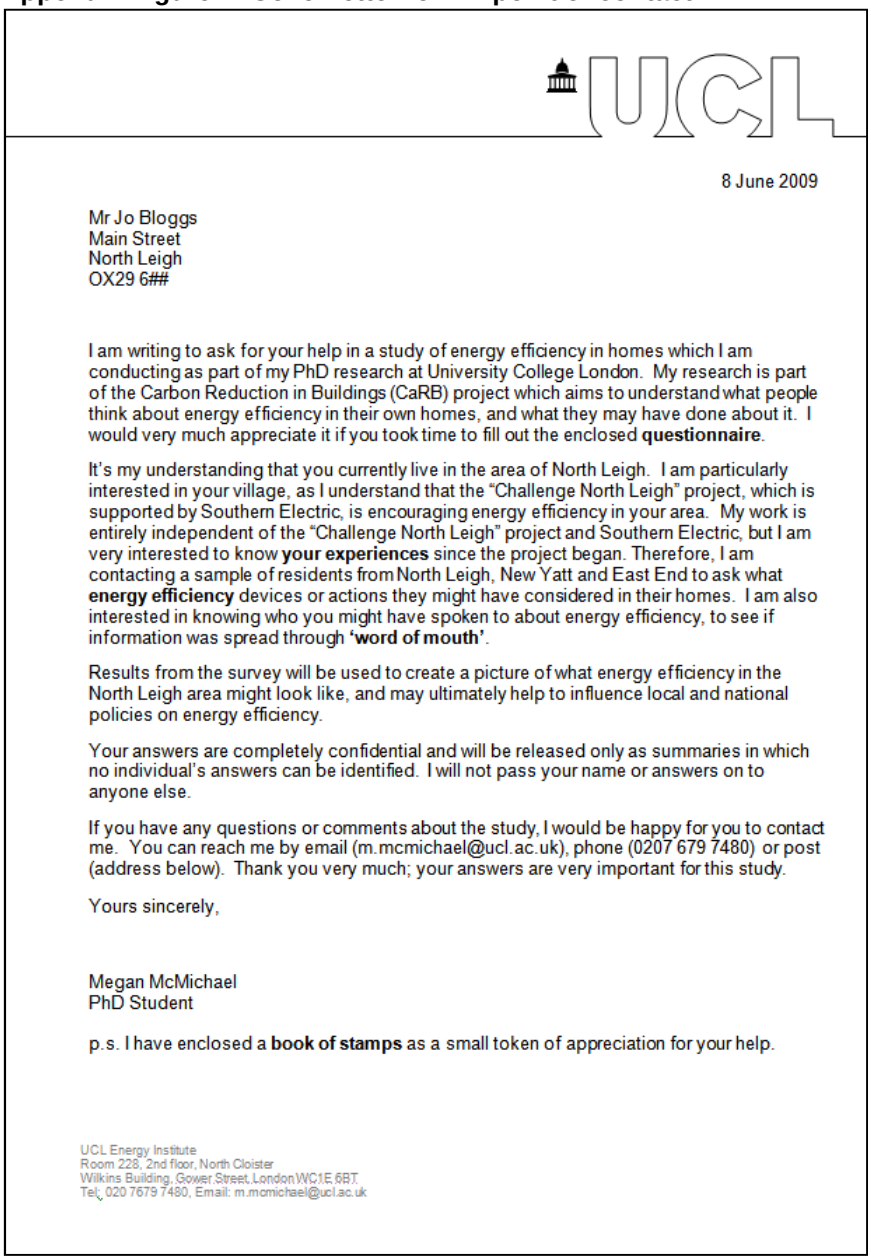
Your data will be confidential to us and is in accordance with the Data Protection Act. All data will be held securely. No one else outside of CaRB will ever be able to connect your personal details to your questionnaire answers, nor will your details be used for marketing purposes.

If for any reason you want to withdraw from the study, you can do so at any time.

2nd point of contact mailing contents

The second point of contact, according to the TDM, includes the questionnaire and a cover letter. The questionnaire is seen in Appendix D, and the cover letter is shown below (Appendix Figure 4). In addition, the mailing included a self-addressed envelope (Appendix Figure 5), a book of six 1st class stamps (Appendix Figure 6),[217] and a postcard asking if the respondent would be willing to take part in further research (see Appendix Figure 7 and Appendix Figure 8).

Appendix Figure 4: Cover letter for 2nd point of contact



UCL

8 June 2009

Mr Jo Bloggs
Main Street
North Leigh
OX29 6##

I am writing to ask for your help in a study of energy efficiency in homes which I am conducting as part of my PhD research at University College London. My research is part of the Carbon Reduction in Buildings (CaRB) project which aims to understand what people think about energy efficiency in their own homes, and what they may have done about it. I would very much appreciate it if you took time to fill out the enclosed **questionnaire**.

It's my understanding that you currently live in the area of North Leigh. I am particularly interested in your village, as I understand that the "Challenge North Leigh" project, which is supported by Southern Electric, is encouraging energy efficiency in your area. My work is entirely independent of the "Challenge North Leigh" project and Southern Electric, but I am very interested to know **your experiences** since the project began. Therefore, I am contacting a sample of residents from North Leigh, New Yatt and East End to ask what **energy efficiency** devices or actions they might have considered in their homes. I am also interested in knowing who you might have spoken to about energy efficiency, to see if information was spread through **'word of mouth'**.

Results from the survey will be used to create a picture of what energy efficiency in the North Leigh area might look like, and may ultimately help to influence local and national policies on energy efficiency.

Your answers are completely confidential and will be released only as summaries in which no individual's answers can be identified. I will not pass your name or answers on to anyone else.

If you have any questions or comments about the study, I would be happy for you to contact me. You can reach me by email (m.mcmichael@ucl.ac.uk), phone (0207 679 7480) or post (address below). Thank you very much; your answers are very important for this study.

Yours sincerely,

Megan McMichael
PhD Student

p.s. I have enclosed a **book of stamps** as a small token of appreciation for your help.

UCL Energy Institute
Room 228, 2nd floor, North Cloister
Wilkins Building, Gower Street, London WC1E 6BT
Tel: 020 7679 7480, Email: m.mcmichael@ucl.ac.uk

[217] Image taken from Royal Mail website, http://www.royalmail.com/gear/shop/html/shopProductPopUp.jsp;jsessionid=ZSYXC4XXVTVIWFB2IGVURWQUHRA0UQ2K?catId=93&product=prod48220073&communityId=900003 [Accessed 09 Sept ember10]

Appendix Figure 5: Picture of the self-addressed stamped return envelope enclosed in the 2nd (and 4th) point of contact

Appendix Figure 6: Image of the incentive (i.e. book of six 1st class stamps) included in the 2nd point of contact (image from Royal Mail website, http://www.royalmail.com/)

Appendix Figure 7: Postcard enclosed in the 2nd point of contact (side 1)

If you would be willing to be contacted in future for further research on this same topic, please fill in your contact details and enclose this postcard along with your questionnaire in the stamped, addressed envelope provided:

Name: _____

Address: _____

_____

Email: _____

Phone: _____

Alternatively, you can email me at m.mcmichael@ucl.ac.uk with the subject "Further Research" and your contact details in the body of the email.

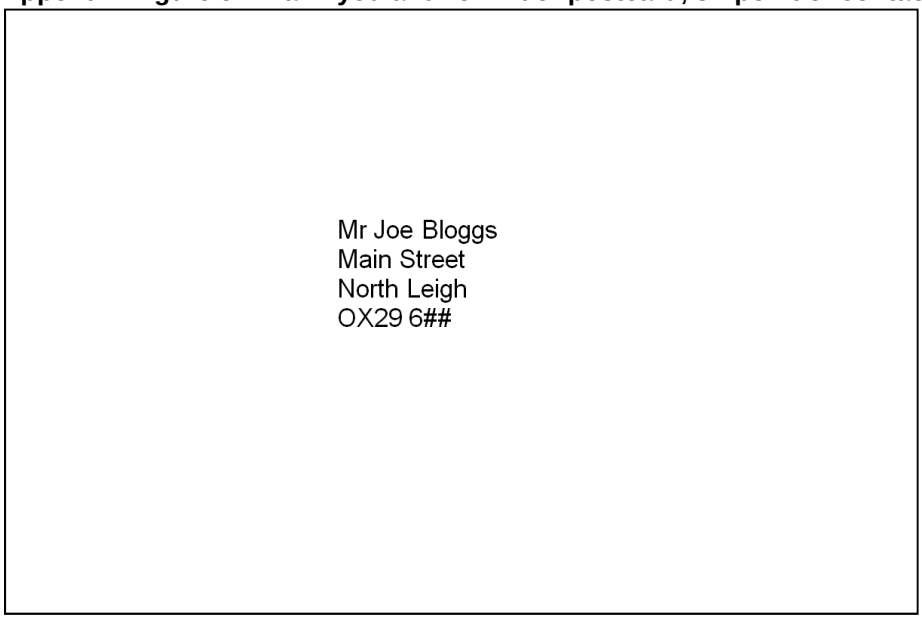
Appendix Figure 8: Postcard enclosed in the 2nd point of contact (side 2)

FAO:
Megan McMichael
PhD Student
University College London

3rd point of contact mailing contents

The third point of contact consisted only of a postcard which both reminded recipients to return their questionnaire and also thanked those who had already returned it (see Appendix Figure 9 and Appendix Figure 10).

Appendix Figure 9: Thank you and reminder postcard, 3rd point of contact (side 1)



Appendix Figure 10: Thank you and reminder postcard, 3rd point of contact (side 2)

18th June 2009

Last week a questionnaire titled 'Energy Efficiency in your Community' was mailed to you.

If you have already completed and returned the questionnaire, please accept my sincere thanks. If not, I hope you will complete and return it as soon as you can. We are especially grateful for your help because it is only by asking people like you to share your experiences that we can understand more about household energy use. Thank you very much.

If you did not receive a questionnaire, or it was misplaced, please call (020 7679 7480) or email (m.mcmichael@ucl.ac.uk) and I will post another one to you.

Megan McMichael
PhD Student
University College London

4th point of contact mailing contents

This section includes the items in the fourth point of contact. It only includes an example cover letter (Appendix Figure 11), as the examples of questionnaires are included in Appendix D and the return envelope was the same as that in the second section of this Appendix.

Appendix Figure 11: Cover letter for 4th point of contact

6 July 2009

Mr Joe Bloggs
Main Street
North Leigh
OX29 6##

Dear Mr Bloggs,

About four weeks ago I sent a questionnaire to you that asked about energy efficiency in your community. I'm afraid that, as of yesterday, I do not have a record of your returned questionnaire. If you have just sent your questionnaire, please accept my thanks for your contribution.

The comments of others in your community include very interesting feedback on what energy efficiency measures they have considered and if information was spread through 'word of mouth'.

I am writing again because of the importance that your questionnaire has for helping us understand more about communication of energy efficiency in North Leigh, New Yatt and East End. Although I sent questionnaires to a sample of residents in the North Leigh area, it is only by hearing from everyone that I can be sure the results are truly representative.

I would be very grateful if you would fill in and return the questionnaire soon, but if for any reason you prefer not to do so, please let me know by returning a note on the questionnaire in the enclosed envelope.

Your answers are completely confidential and my final report will only include a summary of the community findings. I will not pass your name or answers on to anyone else.

Yours sincerely,

Megan McMichael
PhD Student

University College London
UCL Energy Institute, London WC1E 6BT
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Appendix G. FOCUS GROUP QUESTIONING GUIDES & SUMMARIES

This appendix includes all those elements that apply to the qualitative research of the focus groups, which is described in detail in Chapter 7. The first section includes an example of the questioning guides used for the local organising groups and the local residents. The second section includes the direct statements from the transcripts which were deemed by the author to apply to each of the hypotheses. This section includes six tables, two for each community (i.e. one for the local organising group and one for the local residents).

Focus group questioning guides

The following text is an example of the questioning guides which were created for use with the local organising group, e.g. 'Challenge North Leigh'. The questioning guide only varied by community name and local organising group name for the other two communities.

Focus Group: Questioning Guide (Local Organising Group)

Megan's introduction (3 minutes)

- Introduce self
  - PhD at University College London
  - UCL Energy Institute
  - Social research
  - Title of PhD is "Social Capital and the Diffusion of Energy Efficiency in Households"
- Explain research
  - Define social capital & energy efficiency
  - Purpose of research – sometimes assumptions are made about where we get information, which may or may not be correct
  - Understanding where householders prefer to find information on questions for things like energy efficiency might help those who organise campaigns or programmes (SUCH AS YOURSELVES) understand what householders prefer
- Ground rules
  - No interrupting, no expectations, no right or wrong answers, I'm a facilitator to guide the discussion
  - 45 minutes
- Confidentiality
  - Recording – explain doing this so I can remember what everyone says and ask if everyone happy with it
  - All transcriptions / notes will be anonymous when written up, so nothing you say will be linked with your name & no names in final report
  - TURN RECORDER ON

Opening Question (3 minutes)

1. Could you tell us your name and how long you've lived in this area?

Introductory Question (5 minutes)

2. I'm aware that there have been some programmes addressing energy efficiency over the past few years in the area. Can you tell me WHEN YOU FIRST GOT INVOLVED WITH the "Challenge North Leigh" project which is encouraging the community to reduce electricity consumption by 10%?
    a. (Probe: were you in the initial group, or join a bit later?)

Transition Question (5 minutes)

3. HOW MUCH DO YOU THINK the "Challenge North Leigh" project & incentive has MADE THE PEOPLE IN THE COMMUNITY THINK ABOUT ENERGY EFFICIENCY?

Key Questions (25 minutes)

Asking about information

4. In what way do people in the community tend to ask YOU for advice?
    - (Probe: face-to-face at organised 'Challenge North Leigh' events, at other events, individually, via email / website)
5. Who else do you think community members speak to about energy efficiency, besides 'Challenge North Leigh' members?
6. WHO (or what) DO YOU THINK PEOPLE IN THE COMMUNITY TRUST for good answers on energy efficiency?
    - (Probe: family members? A friend who had done it before? Professional? Websites?)
    - (Probe: what makes the answer trustworthy, do you think?)

General conversations

7. Speaking very generally, not necessarily in your capacity as a 'Challenge North Leigh' member, do you remember having any other conversations recently about energy efficiency? IF MANY, THE MOST RECENT. With whom?
    - (Probe: perhaps about insulation, smart meters, light bulbs)
    - (Probe: If hesitation - maybe not asking for information, but just in general – or perhaps even giving your own advice to others)
    - (Probe: if name a person, what is the relation & do they live in North Leigh?)
8. Can you tell me some reasons why people might **not** speak to each other about household energy use & energy efficiency?

North Leigh

9. In what way do you think 'Challenge North Leigh' has been most effective at communicating the message of energy efficiency?
    - (Probe: at events, with advertising in the Norlye News, etc.)
10. If you had a chance to give CHANGE THE COMMUNICATION SIDE OF CHALLENGE NORTH LEIGH, WOULD YOU DO ANYTHING DIFFERENTLY?
    a. (Probe: different types of advertising? More online?)
    b. (Probe: what resources would be necessary for changes?)

Ending question (5 minutes)

11. In terms of people speaking to each other about energy efficiency, do you think North Leigh – as a community – is unique in any way?
    - (Probe: geography, opportunities, social activities, perceptions of energy efficiency)
    - (Probe: anything about North Leigh area that I might not be aware? Such as campaigns that have been involved in, or anything that might have changed the community in past few years?)

Closing

Thank everyone for taking the time to attend

Focus Group: Questioning Guide (Local Residents)

The following text is an example of the questioning guides which were created for use with the local residents in each community. The questioning guide only varied by community name and local organising group name for the other two communities.

Megan's introduction (3 minutes)

- Introduce self
    - PhD at University College London
    - UCL Energy Institute
    - Social research
    - Title of PhD is "Social Capital and the Diffusion of Energy Efficiency in Households"
- Explain research
    - Define social capital & energy efficiency
    - Purpose of research – sometimes assumptions are made about where we get information, which may or may not be correct
    - Understanding where you prefer to find information on questions for things like energy efficiency might help those who organise campaigns or programmes understand what you prefer
- Ground rules
    - No interrupting, no expectations, no right or wrong answers, I'm a facilitator to guide the discussion
    - 45 minutes
- Confidentiality
    - Recording – explain doing this so I can remember what everyone says and ask if everyone happy with it
    - All transcriptions / notes will be anonymous when written up, so nothing you say will be linked with your name & no names in final report
    - TURN RECORDER ON

Opening Question (1-3 minutes)

12. Could you tell us your name and how long you've lived in this area?

Introductory Question (5 minutes)

13. I'm aware that there have been some programmes addressing energy efficiency over the past few years in the area. Can you tell me how you first learned

about the “Challenge North Leigh” project which is encouraging the community to reduce electricity consumption by 10%?

Transition Question (5 minutes)

14. Has the “Challenge North Leigh” project made you think more about energy use in your home?

Key Questions (20-25 minutes)

Asking about information

15. If you had a question about energy use in your home, who would you **trust** to give you a good answer?
    - (Probe: a professional? A friend who had done it before?)
    - (Probe: what makes the answer trustworthy, do you think?)
16. Are there some questions you might ask some people, and others you might ask other people?
    - (Probe: real or hypothetical)

General conversations

17. Do you remember having any other conversations recently about energy efficiency? If so, with whom?
    - (Probe: perhaps about insulation, smart meters, light bulbs)
    - (Probe: If hesitation - maybe not asking for information, but just in general – or perhaps even giving your own advice to others)
    - (Probe: if name a person, what is the relation & do they live in North Leigh?)
18. Can you tell me some reasons why people might **not** speak to each other about household energy use & energy efficiency?

North Leigh

19. In terms of people speaking to each other about energy efficiency, do you think North Leigh – as a community – is unique in any way?
    - (Probe: geography, opportunities, social activities, perceptions of energy efficiency)
    - (Probe: anything about North Leigh area that I might not be aware? Such as campaigns that have been involved in, or anything that might have changed the community in the past few years?)

Ending question (5 minutes)

20. If you had a chance to give advice to people promoting energy efficiency programmes regarding how you receive or find information, what would you say?

Closing

Thank everyone for taking the time to attend

Qualitative research findings by hypothesis

North Leigh

There are two sets of qualitative findings for North Leigh: one for the Challenge North Leigh focus group (Appendix Table 6) and a second which focuses on the residents' responses from the three resident focus groups in North Leigh (Appendix Table 7). Though the names have been anonymised and replaced with codes, a description of each person is included in Appendix Table 8.

Appendix Table 6: Challenge North Leigh focus group findings according to hypotheses

Hypothesis	Challenge North Leigh Qualitative findings from focus group
H1: Where find information	R7 (NL) - "You can hardly ever turn the radio or the television on now or read a newspaper without something of world significance on the matter of climate change." R10(NL): "I've not been involved in the Challenge North Leigh and something clicked when I saw the ad for Age of Stupid. I think it was in the Nor'Lye News and all I can say is that I suppose up until then I had an interest in the issues of climate change." ... "because somebody had suggested that I see the film" R12 (NL) – "I think what persuaded me to eventually do something is because it's had so much national publicity. It's in the newspapers every week, there's something about climate change. It's on the news, on the telly and it just made me realise it's much sooner than we thought it was going to be." R13 (NL) – "And some people don't read newspapers at all." ?? – "No, we very, very seldom have newspapers." R7 (NL): "The Nor'Lye news is, we hope, read by a lot of people, I know perfectly well it isn't. A lot of people don't even bother to read it, put it straight in the bin. ... But we do our best and that is generally, it's my indulgence to put the more serious stuff on the website ..." R11 (NL)? R6 (NL)? – "I have to say I think one of the best initiatives was that £25 voucher, that came out. That you could redeem for light bulbs. Because that's initially what drew me into it, I have to admit. It came through the door, you can redeem it at the Green Fair ..." R11 (NL)? R6 (NL)? – "Yeah, the Green Fair, so we actually came up to have a look at the Green Fair to see what it was all about. And that actually drew us in from outside. If it hadn't been there I don't suppose that we would have done anything about it, because we were just right at the end of the village." R10(NL) – " ... one of the things that motivates me is that I started hearing messages from environmentalists and so on in the news and other places, that actually life could be better through changing one's habits vis-a-vis energy consumption and related things. And I was interested in that ...." R9(NL) – "For the people who don't have time to read this or just read the Nor'Lye News articles, don't have time, whatever it is. Most people in fact like bites of information, virtually everyone. However serious a reader you are, especially if you're busy or whatever. That is very easy to just pick up and browse, so it's very, very straight forward and that's very important." R11 (NL)? R6 (NL)?– "I really do think that R8(NL)'s uniform helps people to trust what he says. And when they come up and talk to us, it's like a general talking, isn't it? But when R8(NL), when they talk to R8(NL), R8(NL) is actually advising them and it looks almost, well it is an official capacity. And I think for some people, that has a greater input than us chatting as ...."
H2: Respondents	R11 (NL)? R6 (NL)? – "Yeah, the Green Fair, so we actually came up to have a

Hypothesis	Challenge North Leigh Qualitative findings from focus group
would approach people in the community	look at the Green Fair to see what it was all about. And that actually drew us in from outside. If it hadn't been there I don't suppose that we would have done anything about it, because we were just right at the end of the village."
H3: Respondents would approach weak ties	R8(NL) – "Yes, certainly as people come in we're very lucky to have light bulb library which is a good focal point .... And suddenly realise that's actually that there's a lot of light bulbs, it's not the ones that we're giving out free. And that often generates conversations."
H4: Think of more people than actually approach?	*Nothing arose in the focus groups*
H5: Speak to someone influence adopting	R8(NL) – "Yes, both in the hall where I have a stand, my initial remit, as you probably know, we're doing two other trials. And this is the only trial that's having a dedicated adviser in the village. So proactively it's for me to approach our customers. But reactively to anybody that asks for advice, then I'll actually go into the houses and offer them advice or help with the cost monitors. The current cost monitors that were given. But once you've got that initial, 'Yes I would love you to talk to me,' that's great. But it's just getting that awareness of getting someone to say, 'Oh yes, could you come and talk to me,' now that's the art." R7(NL) – "Well in one chap who died recently, was a delightful man, I was very fond of him but he said really, 'Crumbs my time of life?' he said, 'You know I've spent every penny I'm going to do on all the measures.' But he was a thoughtful man and had done quite a lot already. But quite firmly but fairly, 'I'm not going to spend any more money on our house.' So age distribution affects it." R9(NL)? – "And we felt that it was important because a lot of people, it's again going back to expense like what I was saying about earlier. People were saying, 'Well I'd like to change that light bulb but if I buy this one from the shop it's,' I think some of them were about £3. But to find the equivalent low energy, LED or whatever was about £15 and sometimes a bit more. And people were saying, 'I've got eight of these, I can't afford that.' But because they could come and get one and try it, people need to try things and feel confident and happy that they're not going to just be wasting their money, don't they? So it drew people in on one side, but also we're hoping that that will actually change behaviour patterns." R7(NL) – "I talked to a lady who announced herself as [NAME]. She said, 'I've done the first bit with the light bulbs.' I mentioned earlier, people start with light bulbs, 'what do I do next'?" R8(NL) – "...certainly when I was talking to people, the group discussion, things you could do for free, that don't cost you anything." R8(NL) – Discussing current cost monitors: "Yeah, I've said this before, I personally feel the most benefit was when it was explained to people." R9(NL) – "... but I've talked to my neighbour a lot and he was interested." R11 (NL)? R6 (NL)?– "I really do think that R8(NL)'s uniform helps people to trust what he says. And when they come up and talk to us, it's like a general talking, isn't it? But when R8(NL), when they talk to R8(NL), R8(NL) is actually advising them and it looks almost, well it is an official capacity. And I think for some people, that has a greater input than us chatting as ...." R9(NL) – "One person said to me, 'Oh well, you know, I don't own this house so I'm not going to do anything.' And I was saying, 'But you could save money on your bills.' 'No, no, not until I've got my own place.'" R8(NL) – "And often, once the people are engaged and talking about that it moves on to other things. Light bulbs seems to the easiest thing because that's what everyone's aware of. And everyone's heard of what we need to do. It's not until you speak to them you think well actually they don't actually know really what to do. I mean most of us here would know what to do. But people are aware that something needs to be done, but not quite sure how to do it. And quite often some of the conversations I've had, as regards to basic energy efficiency in the house, a lot of people, 'Oh I didn't realise that. Oh I'm surprised

Hypothesis	Challenge North Leigh Qualitative findings from focus group
	to hear that.' And it's when you talk to people like that, on a one to one, I find it's quite beneficial."
H5a: Speaking to people in same community influenced adoption	R8(NL) – "Yes, certainly as people come in we're very lucky to have light bulb library [in North Leigh] which is a good focal point .... ." R11 (NL)? R6 (NL)? – "Yeah, the Green Fair, so we actually came up to have a look at the Green Fair to see what it was all about. And that actually drew us in from outside. If it hadn't been there I don't suppose that we would have done anything about it, because we were just right at the end of the village." R9(NL) – "My neighbour, I went round and R8(NL) was sitting in there with a cup of tea busy talking to my neighbour. Helping him to understand all sorts of different things and that was really fantastic as well. Because, this is a slight aside from what I was saying, but I've talked to my neighbour a lot and he was interested. And I said about R8(NL)'s involvement. He contacted R8(NL), and R8(NL) went round as an appointment and my neighbour then didn't feel he was taking my time, which he knows is a bit short. So that is another element to having Rob's time. Certainly for some people, they see it as something that they need to deal with, rather than pestering somebody else about it." R11 (NL)? R6 (NL)?– "I really do think that R8(NL)'s uniform helps people to trust what he says. And when they come up and talk to us, it's like a general talking, isn't it? But when R8(NL), when they talk to R8(NL), R8(NL) is actually advising them and it looks almost, well it is an official capacity. And I think for some people, that has a greater input than us chatting as ...."
H5b: Speaking to strong ties influenced adoption	R13 (NL) – "It was interesting talking to a young family at one of these events that we had here. And the mum said, 'Well we decided to do our bit and we sat down as a family.' Now with two children and mum and dad are all sitting round together, and they decided that there was so many electrical gadgets round the house that they would try switching off one or two of them. And of course with the current cost monitor they could see the effect. And the effect was so startling that it's changed their way of life. And it just needed that.." R9(NL) – "My neighbour, I went round and R8(NL) was sitting in there with a cup of tea busy talking to my neighbour. Helping him to understand all sorts of different things and that was really fantastic as well. Because, this is a slight aside from what I was saying, but I've talked to my neighbour a lot and he was interested." R9(NL) – "It's like my neighbour, he was happy to just chat to me about it and then he took another step. And lots of other people have asked me all sorts of questions, constant sort of questions. And I think that they receive it well and if I don't know the answer I'll just say I don't know, I'll have to go and find it out. Or, R8(NL) may be following later anyway and I think once or twice we've sort of referenced things back. And I know other people have done that with R8(NL). So I think it works both ways."
H5c: Speaking with people 'like me' influenced adoption	*Nothing arose in the focus groups*
H5d: Speaking with more people influenced adoption	R9(NL) – "My neighbour, I went round and R8(NL) was sitting in there with a cup of tea busy talking to my neighbour. Helping him to understand all sorts of different things and that was really fantastic as well. Because, this is a slight aside from what I was saying, but I've talked to my neighbour a lot and he was interested." R9(NL) – Referring to same neighbour: "It's like my neighbour, he was happy to just chat to me about it and then he took another step." R11 (NL)? R6 (NL)? – "I really do think that R8(NL)'s uniform helps people to trust what he says. And when they come up and talk to us, it's like a general talking, isn't it? But when R8(NL), when they talk to R8(NL), R8(NL) is actually advising them and it looks almost, well it is an official capacity. And I think for some people, that has a greater input than us chatting as ...."
H5e: Speaking to	R11 (NL)? R6 (NL)? – "I really do think that Rob's uniform helps people to trust

Hypothesis	Challenge North Leigh Qualitative findings from focus group
people who give positive advice influenced adoption	what he says. And when they come up and talk to us, it's like a general talking, isn't it? But when R8(NL), when they talk to R8(NL), R8(NL) is actually advising them and it looks almost, well it is an official capacity. And I think for some people, that has a greater input than us chatting as ...."

Appendix Table 7: Findings from the three North Leigh residents focus groups according to hypotheses

Hypothesis	Residents focus group qualitative findings in North Leigh
H1: Where find information	R4(NL): "It was in the Nor'Lye News. Our local "rag" as we call it." R1(NL): Speaking of R7 (NL): "... we've read what's in the Nor'Lye News and I don't feel that we've been, it's probably our mistake, our shortcoming, we haven't taken things further." *"Megan: Can you tell me how you first learnt about the Challenge North Leigh project, do you remember?* R14(NL) - I don't remember now. But I know I've got a file here. R15(NL) - Probably it's from the No'rLye news." R14(NL) - "Well there's been a lot of paper over the months, as you can see, and I've learnt quite a bit from that ..." R14(NL) – "Well I think I would trust somebody from the company, you know, the electricity company. You can soon find out how knowledgeable he was. I don't know otherwise." R18(NL): "Yeah, I mean whenever it started I can remember seeing something in the Nor'Lye News, which is our North Leigh bible, and I think I probably, I glazed over the first time. Then it was repeated. So then you begin to think well there might be something in it." R17(NL): "Some of them are from Southern Electric, aren't they? When they're in their little tent, they are ideal, they're really good and they give you some very good advice." R19(NL) – "Depending on what it is, I would probably go and have a word with R7 (NL) first, because he's there. R18(NL): He's your neighbour. R19(NL): He's my neighbour, yeah."
H2: Respondents would approach people in the community and H3: Respondents would approach weak ties	R1(NL): "I'd probably trust a neighbour. So having, having met these people who have lived in the same village of them for six years but I haven't met them yet. I'd probably trust these people. I'd probably trust local people who live close to me, and who have the same kinds of concerns and irritations. Or R7 (NL), who's got tremendous interest and enthusiasm." R5(NL): "But it's come back to basics, like trusting your neighbour for advice. R1(NL): Yeah. R4(NL): But in the village that's more likely to occur, isn't it? There is a certain sort of bonding in villages as opposed to towns, I'm sure." R1(NL): "And I think something like this is much more effective if it is community based. But, I think that requires ... someone with real energy and passion. The reason we've got Challenge North Leigh is that one person said I want to do it." R19(NL) – "Depending on what it is, I would probably go and have a word with R7 (NL) first, because he's there. R18(NL): He's your neighbour. R19(NL): He's my neighbour, yeah." R19(NL) – "Apart from speaking to R7 (NL), because he'll probably bring the subject up to me, there's nobody outside I would talk to or probably think at all about it."
H4: Think of more people than actually approach?	*Nothing arose in the focus groups*

Hypothesis	Residents focus group qualitative findings in North Leigh
H5: Speak to someone influences adopting	R1(NL): "About a month ago I was in touch with our supplier because I was trying to persuade them to charge me less, I was trying to threaten that I would change supplier. It didn't work. But they did tell me about this scheme which they were on, which I had no idea that it existed at all. So I suppose in the last month I've certainly thought about it at least every week." "R17(NL): Were you encouraged to do the thermal imaging, to get that done? R19(NL): No, I just got fed up with painting." R18(NL) - "I have an acquaintance who's very much into this, alternative energies and so on, and he came one day and sat in my lounge and he looked around and he said, "You've not got many energy-saving bulbs, do you?" And I said, Well of course it doesn't fit here because we've got different lamp shades and things," but then you think perhaps they do after all." R18(NL): "This afternoon I was talking to somebody about this very thing, about the fact that you put in these energy efficient bulbs and they aren't, they take ages to warm up to the intensity that you want them."
H5a: Speaking to people in same community influenced adoption	R3(NL): "Well we did [speak to someone], with our neighbour. R4(NL): Yes, we did." R14(NL) - "Could I just ask another me question, as it were, a more practical one. With regard to the central heating, recently we've had it on 'on', you know you can adjust, and we've controlled it by the thermostat in the hall, which is quite a good way you know. But I used to have it on once, the setting called 'once' which went on in the morning about half past seven, and switched off at night at ten, then obviously what you did with it in the day time is up to you again. But there is a setting 'twice' and I've been to the … I mean I'm ashamed to mention this because I was a scientist, now I find all the pressing of buttons so complicated, I'm going to have another go." Later: R14(NL) - "Anyway I've found this little meeting quite helpful to share things." Later: R14(NL) – "Well I've been helped by all this. I wouldn't say I enjoyed, but I have enjoyed, but I've been helped by the colleagues." R19(NL): "Depending on what it is, I would probably go and have a word with R7 (NL) first, because he's there. R18(NL): He's your neighbour. R19(NL): He's my neighbour, yeah." (North Leigh, Resident focus group 3) R4 (NL): "Yes, yes. But, for nine years old, if anything goes wrong with the telly, you can't do it, get [neighbour's child] in from next door, he sorts it."
H5b: Speaking to strong ties influenced adoption	R1(NL): "About a month ago I was in touch with our supplier...." R1(NL): Regarding energy efficiency incorporating into renovations: "Yes, spoken to the supplier. Spoken to my builder. Spoken to the, I had a conversation with the engineer at work. R5(NL): And your wife? R1(NL): And my wife? Yes. [Laughter.] Certainly." R14(NL) – "I had the chap along and we've had more insulation put in. He went around the house and so on. I found that very helpful ... I think it was someone from the electricity [supplier]. Yeah. They recommended one or two firms." R14(NL) - "Could I just ask another me question, as it were, a more practical one..." R18(NL) - "I have an acquaintance who's very much into this, alternative energies and so on, and he came one day and sat in my lounge and he looked around and he said, "You've not got many energy-saving bulbs, do you?" Megan: "My next question is just about your last conversation about energy efficiency, if you can remember. What was the last thing you talked about with somebody and who did you talk to?" R17 (NL): "My boyfriend wanted to run off with my meter." [Laugh.] Megan: "The cost meter?"

Hypothesis	Residents focus group qualitative findings in North Leigh
	R17 (NL): "Yeah. Absolutely." R19(NL) – "I don't know where she got it from, but my wife got a little device which plugs into the wall and automatically switches. ... If I switch off the television it automatically switches off to standby after 20 seconds and I have to press the button twice to turn it back on again."
H5c: Speaking with people 'like me' influenced adoption	R1(NL): "I'd probably trust local people who live close to me, and who have the same kinds of concerns and irritations."
H5d: Speaking with more people influenced adoption	R18(NL) – "I certainly wouldn't expect to ask just one person. If you've got something you're thinking, you ask around and you get people's experiences as well and of course this energy saving is all very well, but you're never comparing like with like, are you?"
H5e: Speaking to people who give positive advice influenced adoption	R18(NL): "This afternoon I was talking to somebody about this very thing, about the fact that you put in these energy efficient bulbs and they aren't, they take ages to warm up to the intensity that you want them."

Appendix Table 8: Coding and details of respondents in focus groups (North Leigh)

Respondent reference	Focus group	Gender	Age range
R1(NL)	Residents	Male	45-64 years
R2(NL)	Residents	Male	65-74 years
R3(NL)	Residents	Female	65-74 years
R4(NL)	Residents	Male	75+[218]
R5(NL)	Residents	Female	Uncertain[219]
R6(NL)	Local organising group (Challenge North Leigh)	Female	Data not collected
R7(NL)	Local organising group (Challenge North Leigh)	Male	Data not collected
R8(NL)	Local organising group (Challenge North Leigh)	Male	Data not collected
R9(NL)	Local organising group (Challenge North Leigh)	Female	Data not collected
R10(NL)	Local organising group (Challenge North Leigh)	Male	Data not collected
R11(NL)	Local organising group (Challenge North Leigh)	Female	Data not collected
R12(NL)	Local organising group (Challenge North Leigh)	Female	Data not collected
R13(NL)	Local organising group (Challenge North Leigh)	Female	Data not collected
R14(NL)	Residents	Male	75+
R15(NL)	Residents	Male	65-74 years
R16(NL)	Residents	Male	45-64 years[220]
R17(NL)	Residents	Female	45-64 years
R18(NL)	Residents	Male	65-74 years
R19(NL)	Residents	Male	45-64 years

St Athan Qualitative Findings

There are two sets of qualitative findings for St Athan: one for the Get Smart with St Athan focus group (Appendix Table 9) and a second which for the interview of the one resident who showed up for the residents focus group (Appendix Table 10). Though the names have been anonymised and replaced with codes, a description of each person is included in Appendix Table 11.

[218] This age range is an assumption; the person did not answer the questionnaire, his partner (R3(NL) did. The author met both, and suspects this might be a correct assumption.
[219] This woman was the partner of R2 (NL). Though this person's age was not ascertained from the questionnaire, it was stated in the focus groups (as stated in the Transcriptions below).
[220] This age range is an assumption; it was actually this person's partner who was replied to the questionnaire, but he took her place in the focus group. Assuming they are close in age, this would be correct. (The author also met this person's partner, so this is also based on a personal observation.)

Appendix Table 9: 'Get Smart with St Athan' focus group findings according to hypotheses

Hypothesis	'Get Smart' Qualitative findings from focus group
H1: Where find information	R2(SA) – "And it's only when we've held events like that, that people have come and just come to talk to us, 'what is it about? what you giving away?' [laughter] and sort of, leaflets. I don't think we've been approached by anyone other than at an event really." R4(SA) – "I've had a couple of phone calls from people after we've leafleted just wanting some further advice on when we've leafleted on insulation grants and that sort of thing. A couple of people have rung me, but not many, to say 'what do I do next', well read the leaflet [laughter] it tells you." R9(SA) – "We've had a couple of people coming through to the Local, asking the Local Authority from St Athan, not necessarily knowing about this Group though I think though, but just general, you know, I don't know, I probably, we haven't checked, we haven't said, are you doing this because of Get Smart with St Athan or just because you want to get your house insulated, but we've had a few." R5(SA) – "We've also had some enquiries that have come to SSE because the smart metering elements of it, so that's been covered as well, so there has been some interaction." R4(SA) – "If he'd been getting round, knocking on doors he might well have engaged more people than we've managed to engage." R9(SA) –"I think they do believe the Local Authority to be honest with you. [Several] Yeah. R9(SA) - They have faith if we offer them something, they trust us I think." R2(SA) – Trust for advice: "And probably their own energy supplier as well, because whoever your energy supplier is, you do get stuff through the post and if you are online then there's always stuff online, so I would think possibly their own individual energy suppliers." R9(SA) – "They trusted EST as well to be honest with you, I'm sure they do, yeah." R9(SA) – "You can't beat the personal recommendation." R9(SA) – "There's no better recommendation and that's why the personal contact's so important, because you can read it on a piece of paper ... you think oh interesting, but when you've actually seen somebody do it, and they say 'eh it's really good', then that's the way it works best, yeah." R2 (SA): "Yeah, but if they need to switch on the television and saw St Athan was on the news I think people would have been quite excited about it."
H2: Respondents would approach people in the community	*Megan: "So what does [SSE NAME] do now, does he go house to house, or does he...?* R5 (SA): Yeah, he picks up enquiries, he goes into the library. R4 (SA): He does a surgery in the library." R2(SA) – "And it's only when we've held events like that, that people have come and just come to talk to us, 'what is it about? what you giving away?' [laughter] and sort of, leaflets. I don't think we've been approached by anyone other than at an event [in St Athan] really." R2 (SA): "We got dragged along to one of the first meetings 'cause R1 (SA) worked with somebody who was already on the Committee or had gone along to meetings, so you got approached in a corridor in work." R2 (SA): "I do tend to talk about it a bit more, I've recently started a new job and I now travel round the country visiting firms ... and it does come up on the back of data protection, so you end up with data protection and shredding confidential waste, which then leads into where does your other paper waste go, well where does your recycling go, well where does your energy efficiency, there's a long chain, but yeah."

Hypothesis	'Get Smart' Qualitative findings from focus group
H3: Respondents would approach weak ties	R2(SA) – "And it's only when we've held events like that, that people have come and just come to talk to us, 'what is it about? what you giving away?' [laughter] and sort of, leaflets. I don't think we've been approached by anyone other than at an event really." R4(SA) – "I've had a couple of phone calls from people after we've leafleted just wanting some further advice on when we've leafleted on insulation grants and that sort of thing. A couple of people have rung me, but not many, to say 'what do I do next', well read the leaflet [laughter] it tells you." R9(SA) – "We've had a couple of people coming through to the Local, asking the Local Authority from St Athan, not necessarily knowing about this Group though I think though, but just general, you know, I don't know, I probably, we haven't checked, we haven't said, are you doing this because of Get Smart with St Athan or just because you want to get your house insulated, but we've had a few." R5(SA) – "We've also had some enquiries that have come to SSE because the smart metering elements of it, so that's been covered as well, so there has been some interaction." R4(SA) – Re: conversations: "Yeah, with my wife and my son when I go around switching everything off."
H4: Think of more people than actually approach?	*Nothing arose in the focus groups*
H5: Speak to someone influence adopting	R7(SA) –"I'd say what R9(SA) said about that personal stuff, my experience is when you go into a new place and you get like one or two, you'd go [?? 0:36:37] or whatever and someone brave says, 'oh well I'll have a few to go and check out the house' or whatever they do, and then they say 'what do you do with it', and then later they might say yeah I'll go for it and you get that, that personal. R9(SA) - You can't beat the personal recommendation." "R9(SA) - I mean we're all like it, aren't we? I'm doing other projects in the council and I phone other Local Authorities and I say 'have you done it?' And if they've done it and it's worked I think 'oh that must be okay then'. There's no better recommendation and that's why the personal contact's so important, because you can read it on a piece of paper ... you think oh interesting, but when you've actually seen somebody do it, and they say 'eh it's really good', then that's the way it works best, yeah."
H5a: Speaking to people in same community influenced adoption	R2(SA) – "I think I've had conversations in the pub as well, when one of the pubs have had new light bulbs or something had happened in the pub you do just start talking about it, it's like ooh they are saving electricity in the pub."
H5b: Speaking to strong ties influenced adoption	R4(SA) – Re: conversations: "Yeah, with my wife and my son when I go around switching everything off." R4(SA) – "We have quite a throughput of people in our house, especially at coffee time or whatever and we are using the eco-kettle and that's quite a topic of conversation when people see it for the first time and when they try and use it for the first time as well and they don't know what they are doing." R2(SA) – "And it's only when we've held events like that, that people have come and just come to talk to us, 'what is it about? what you giving away?' [laughter] and sort of, leaflets. I don't think we've been approached by anyone other than at an event really." M*egan: "So what does [SSE NAME] do now, does he go house to house, or does he...?* R5 (SA): Yeah, he picks up enquiries, he goes into the library. R4 (SA): He does a surgery in the library."
H5c: Speaking with people 'like me' influenced adoption	*Nothing arose in the focus groups*

Hypothesis	'Get Smart' Qualitative findings from focus group
H5d: Speaking with more people influenced adoption	*Nothing arose in the focus groups*
H5e: Speaking to people who give positive advice influenced adoption	R7 (SA): "It would be interesting to know if anything's, when [SSE NAME] takes the kettle to the house or whatever happens, whether anything happens after that, there's that follow up."

Appendix Table 10: St Athan resident interview findings according to hypotheses

Hypothesis	Resident findings from St AThan focus group
H1: Where find information	*Megan: "Okay, good. Do you remember how you heard about it? Did somebody tell you about it, or did you see a leaflet?* R10(SA): "It was probably initially, TV." *Megan: "... if you have a question about energy use in your home, who would you trust to give you a good answer? ...* R10(SA): Myself. [laughter] *Megan: Yourself? Okay. You've had lots of training.* R10(SA): I think that is why I trust myself. Because some of the information is, I think biased."
H2: Respondents would approach people in the community and H3: Respondents would approach weak ties	*Megan: "Who do you speak to about that? Your family or friends?* R10(SA): Well, it's family isn't it. It's got to be."
H5b: Speaking to strong ties influenced adoption	*Megan: "Who do you speak to about that? Your family or friends?* R10(SA): Well, it's family isn't it. It's got to be."

Appendix Table 11: Coding reference and details of respondents in focus groups, St Athan

Respondent reference	Focus group	Gender	Age range
R1(SA)	Local organising group (Get Smart)	Male	Data not collected
R2(SA)	Local organising group (Get Smart)	Female	Data not collected
R3(SA)	Local organising group (Get Smart)	Female	Data not collected
R4(SA)	Local organising group (Get Smart)	Male	Data not collected
R5(SA)	Local organising group (Get Smart)	Female	Data not collected
R6(SA)	Local organising group (Get Smart)	Male	Data not collected
R7(SA)	Local organising group (Get Smart)	Male	Data not collected
R8(SA)	Local organising group (Get Smart)	Female	Data not collected
R9(SA)	Local organising group (Get Smart)	Male	Data not collected
R10(SA)	Resident	Male	65-74 years

Alyth Qualitative Findings

There are two sets of qualitative findings for St Athan: one for the Alyth Energy Challenge focus group (Appendix Table 12) and a second which for the interview of the residents (Appendix Table 13). Though the names have been anonymised and replaced with codes, a description of each person is included in Appendix Table 14.

Appendix Table 12: 'Alyth Energy Challenge' focus group findings according to hypotheses

Hypothesis	Alyth Energy challenge Qualitative findings from focus group
H1: Where find information	R9(AL) –"We leafleted everyone, didn't we. There's over fourteen hundred, not much over fourteen hundred, but over fourteen hundred households, that are counted to be within the Alyth boundary. We got four hundred replies [from] people who were interested in some kind of energy information for their house. And of those, we saw about 300, roughly. ... And, I would say, of people I saw, some of them were already very energy efficient, and very knowledgeable, but they were also very interested in everything we could tell them. And some weren't very knowledgeable, and were very pleased to get the information and were keen to know more." R9(AL) –"I would say the most effective thing is when, if you've been in to a house, and you've given advice, and it's always good advice, you know, when it's good advice, that that person then speaks to a neighbour. These are the people that are now drifting in, we're getting taking enquiries from people who were never a part of the initial survey, never filled in the initial questionnaire and did it online or whatever. And now they're speaking to other people in the town ... and now they're coming to us so they can get advice as well" R10(AL) – "But it's the communication, this communication in the form of talking. ... I think has brought most people on to energy conservation that are now aware of it in Alyth ... More than reading about it in the Alyth Voice" R9(AL) – "And I think now, what would be really good now, is that there is still point of contact with the community, cause the word is spreading, that the community feels that they've got somewhere to go in the town to ask for information, cause that's what the individuals now want that."
H2: Respondents would approach people in the community and H3: Respondents would approach strong ties / weak ties	R5(AL) – "Certainly now you, do see the local people and they, they stop [you] in the street. Based on the logo on the shirt. So ... there is penetration there now. You'd have to say probably better than it was before." ??? –"It's a also small, but it's a discernable response from people who didn't reply to the original questionnaire as well. And they begin to trickle in, by word of mouth." R5(AL) – "I think we've been asked on the doorsteps, when we say we're an energy auditor with ACAT, which is what we were saying, they said, 'well, what are ACAT?' And then I'd explain that it's a street-by-street energy awareness, education insulation project. And I think that what we were and what we stood for was actually important to the community." R9(AL) –"I would say the most effective thing is when, if you've been in to a house, and you've given advice, and it's always good advice, you know, when it's good advice, that that person then speaks to a neighbour. These are the people that are now drifting in, we're getting taking enquiries from people who were never a part of the initial survey, never filled in the initial questionnaire and did it online or whatever. And now they're speaking to other people in the town ... and now they're coming to us so they can get advice as well"
H4: Think of more people than actually approach?	R5(AL) – "Certainly now you, do see the local people and they, they stop [you] in the street. Based on the logo on the shirt. So ... there is penetration there now. You'd have to say probably better than it was before."
H5: Speak to someone influence adopting	R9(AL): "...and that's the thing about the street-by-street project, is we're finding that people ARE responding to the face, the human face, knocking on the door, and delivering energy efficiency at the threshold of people's houses." R9(AL) – "One of the things I found interesting is that there are people in the community, and in any community, who don't see themselves as what you would call green, but who are running their lives and their homes in a very energy efficient way. And they want you to tell them ... they want to invite you in, knowing that they're probably doing everything, but they love you to say, 'Gah, you're doing really well'. They really like that, the feedback." R11(AL) – "We'd rather wait for it to go and then get a pilot boiler in or something"

Hypothesis	Alyth Energy challenge Qualitative findings from focus group
	R9(AL) – "People still speak about smart meters. R14(AL) – Yeah R9(AL) – Yeah, and people that didn't get them, cause they weren't suitable or whatever, are still miffed about it. ' I never got a smart meter!' R14(AL) – I've still got people on the phone asking for smart meters." R9(AL) – "Yeah, that's the difference with the current cost monitors, because you have to go in and set them for people. R11(AL) – Well, there, alot of them are straightforward as well R9(AL) – Yeah, but we taught people how to use them as well, yeah. And often people get them because they've asked for them, rather than, you know, just being given them."
H5a: Speaking to people in same community influenced adoption	R9(AL) –"I think it's good, the people we're getting now ... who are asking questions, who maybe – they're not really interested in the form, they don't want the report, they don't want to be bothered with the questionnaire, but they do want the advice." R5(AL) – "Certainly now you, do see the local people and they, they stop [you] in the street. Based on the logo on the shirt. So ... there is penetration there now. You'd have to say probably better than it was before." ??? –"It's a also small, but it's a discernable response from people who didn't reply to the original questionnaire as well. And they begin to trickle in, by word of mouth."
H5b: Speaking to strong ties influenced adoption	R9(AL) –"I think it's good, the people we're getting now ... who are asking questions, who maybe – they're not really interested in the form, they don't want the report, they don't want to be bothered with the questionnaire, but they do want the advice." R14 (AL) – "[SSE have] still got people on the phone asking for smart meters."
H5c: Speaking with people 'like me' influenced adoption	*Nothing directly arose in the focus groups*
H5d: Speaking with more people influenced adoption	R9(AL) –"I would say the most effective thing is when, if you've been in to a house, and you've given advice, and it's always good advice, you know, when it's good advice, that that person then speaks to a neighbour. These are the people that are now drifting in, we're getting taking enquiries from people who were never a part of the initial survey, never filled in the initial questionnaire and did it online or whatever. And now they're speaking to other people in the town ... and now they're coming to us so they can get advice as well"
H5e: Speaking to people who give positive advice influenced adoption	R9(AL) –"I would say the most effective thing is when, if you've been in to a house, and you've given advice, and it's always good advice, you know, when it's good advice, that that person then speaks to a neighbour." R9(AL) – "People who were given wrong advice in the past, like it's ok if you're out at work all day, it's better to keep your heating on, all day, rather than heat your house up from cold when you come home. Because somebody who they had respect for told them that. They carried on doing that." R9(AL) – "Well we've come across a problem with the contractor that's been doing the insulation, because we've happily gone in and explained to people how we think certain measures would improve the energy efficiency of their home. And then the contractor, who was to carry out some other work has given them completely [different] advice, they say, well actually topping up your loft insulation isn't going to save you any money, or draught-stripping that door isn't going to save you any money. Because they're doing the work they want to make a profit, and if they don't see a profit in the work, then they want the person to take off that work. And people will .. I mean, they have come back to us a bit disappointed that the contractor said that. But then they're left trying to decide, have we given them the wrong information, or is the contractor, you've got to battle it to bring those people back." R9(AL) – "One of the other conflicts that we've come across was the number of people who have had heating systems put in without room thermostats. You know,

Hypothesis	Alyth Energy challenge Qualitative findings from focus group
	they were told, as far as they were concerned, reliably, by the people putting in the heating system that they don't need a room thermostat. And when I tell them they do need a room thermostat." R9(AL) – "You need, one of the things to engage the community is to be able to give positive feedback, so whatever way, you have to find a way that you can give positive feedback. And if can only give got negative feedback, then you have to be careful in how you do it. So, if you can show people that they're already making a difference then people, some people, and a lot of people, will then be prepared to try a wee bit harder to make another difference. But if they don't see that they're making a difference, it's easier just to give up, especially if they have been trying."

Appendix Table 13: Alyth residents focus group findings according to hypotheses

Hypothesis	Residents focus group qualitative findings in Alyth
H1: Where find information	R4(AL): "I saw something in Alyth Voice about it we have got a little local newspaper called the Alyth Voice so a lot of the information goes into that." *Megan: "... if you had a question about energy use in your home who would you trust to give you good information or to give you a good answer?* R2(AL): The Hydro board, I'd imagine. R4(AL): I would look it up on the web. R3(AL): My bills, I got a big bill I would panic. I believe my bills. R1(AL): I tend to investigate these things myself, so I would read the back of devices and see what the ratings are on motors and pick up manuals and see what energy consumptions are and things like that. I think that is probably more the approach I do, sometimes look things up on the web. R4(AL): You might discuss things with other people and say I am doing this what are you doing, but I don't think you would go around to your neighbour and ask their advice."
H2: Respondents would approach people in the community	R4(AL): "You might discuss things with other people and say I am doing this what are you doing, but I don't think you would go around to your neighbour and ask their advice."
H3: Respondents would approach strong ties / weak ties	R4(AL): "I think a lot of older people don't know what they are entitled to as well. R3(AL): No but the daughters should be able to tell them or the son, or whoever can." R4(AL): "You might discuss things with other people and say I am doing this what are you doing, but I don't think you would go around to your neighbour and ask their advice."
H4: Think of more people than actually approach?	*Nothing directly arose in the focus groups*
H5: Speak to someone influence adopting	R4(AL): Current cost monitor: "They came from the Hydro board didn't they? R2(AL): That's right I had to ask for mine." R1(AL): "And that is still working its way through people because someone came and did our energy audit just last Monday of last week and we are waiting for our monitor meter to arrive and all that." R2(AL): "A lady came to visit I had a visitor who went through various things, helpful tips." R2(AL): "We actually got a gadget from [Energy Auditor in ACAT] when she came and put it on where the computer is to switch all the little lights off. ... It is like a rocker switch. ... And that switches all the little bits off because it is all underneath it is difficult to get at." R4(AL): Talking about energy efficiency to people: "But I must admit I hear it mentioned quite a lot. I mean my neighbours talk about it and I have got friends when I got that little monitor thing said why we haven't got one and got onto the Hydro board and said where is ours. So I think people do."
H5a: Speaking to	R2(AL): "A lady came to visit I had a visitor who went through various things,

Hypothesis	Residents focus group qualitative findings in Alyth
people in same community influenced adoption	helpful tips. *Megan: Where was she from?* R2(AL): Alyth." R4(AL): "You might discuss things with other people and say I am doing this what are you doing, but I don't think you would go around to your neighbour and ask their advice."
H5b: Speaking to strong ties influenced adoption	R4(AL): "I have got friends when I got that little monitor thing said why we haven't got one and got onto the Hydro board and said where is ours."
H5c: Speaking with people 'like me' influenced adoption	*Nothing directly arose in the focus groups*
H5d: Speaking with more people influenced adoption	*Nothing directly arose in the focus groups*
H5e: Speaking to people who give positive advice influenced adoption	*Nothing directly arose in the focus groups*

Appendix Table 14: Coding reference and details of respondents in focus groups, Alyth

Respondent reference	Focus group	Gender	Age range
R1(AL)	Residents	Male	45-64 years
R2(AL)	Residents	Female	65-74 years
R3(AL)	Residents	Male	65-74 years
R4(AL)	Residents	Female	45-64 years
R5(AL)	Local organising group, Alyth Energy Challenge	Male	Data not collected
R6(AL)	Local organising group, Alyth Energy Challenge	Male	Data not collected
R7(AL)	Local organising group, Alyth Energy Challenge	Male	Data not collected
R8(AL)	Local organising group, Alyth Energy Challenge	Male	Data not collected
R9(AL)	Local organising group, Alyth Energy Challenge	Female	Data not collected
R10(AL)	Local organising group, Alyth Energy Challenge	Male	Data not collected
R11(AL)	Local organising group, Alyth Energy Challenge	Male	Data not collected
R12(AL)	Local organising group, Alyth Energy Challenge	Male	Data not collected
R13(AL)	Local organising group, Alyth Energy Challenge	Female	Data not collected
R14(AL)	Local organising group, Alyth Energy Challenge	Male	Data not collected

Appendix H. ETHICS

Primary source social research necessarily involves some form of contact and interaction with the people being studied, i.e. the potential respondents, which require ethical considerations. As Diener & Crandall (1978) indicate, there are four main areas of concern regarding ethics in social and behavioural research, which are examined below. Each of these issues was addressed, as is evidenced through registration with the UCL Data Protection Officer and obtainment of a Data Protection number; the completion of a formal risk assessment; and permission granted by the UCL Ethics Committee.

The British Sociological Association recommends that “Wherever possible [researchers] should attempt to anticipate, and to guard against, consequences for research participants that can be predicted to be harmful" (BSA 2002, p.4). In quantitative research, this involves careful consideration of wording in questionnaires, particularly if they pertain to a sensitive topic, and assuring confidentiality. The nature of social network questions can be considered intrusive, particularly if asking for other people’s details. For this reason, the questionnaire indicated that only the respondent could enter only initials of people with whom they had spoken regarding energy efficiency. It was believed this would not only alleviate feelings of intrusion, but also increase response rates. Confidentiality was assured to potential participants with potential respondents who received the questionnaire: it was stated in the pamphlet, on the questionnaire itself, and in each cover letter. Further, all items containing personal information were kept secure. Electronic files containing names and addresses of respondents were electronically zipped and password protected on a password protected laptop computer. Questionnaires would not contain personal information (i.e. name & address) of the respondent, but would contain initials and possibly names of social contacts of that respondent. These paper questionnaires were thus kept in a locked filing cabinet. Postcards that indicated the respondent had agreed to be contacted for further research contained personal information (name, address and other contact details such as phone number or email address) and were also kept in a locked filing cabinet. Respondents were assured that all data would be represented anonymously. In the case of qualitative focus groups, respondents were told that their conversation was recorded, and also assured that their name would never be linked with what they said. No objections were raised.

The British Sociological Association states that: "As far as possible participation in sociological research should be based on the freely given informed consent of those

studied" (BSA 2002, p.3). In the research presented here, all the details of the research were presented to potential respondents, but an appeal was made to the UCL Ethics Committee to waive the requirement for written informed consent. The reasons for requesting waiving consent were: 1) respondents were told clearly that their involvement was voluntary and that they could withdraw at any time; 2) the research did not involve procedures for which written consent is normally required; and 3) requiring written consent of a questionnaire would likely be detrimental to response rates, as it increases respondent burden and adds unnecessary responsibility to the respondent. The pamphlet and other materials would contain the following information, which would enable the person to make an unwritten informed consent: 1) the title of the study was present in lay language; 2) a statement was made of voluntary involvement; 3) the aims of the research were stated; 4) the funder of the project were made clear; 5) a statement was given of who was being recruited; 6) study results were explained, and an offer was made to make them available to the respondent; 7) possible benefits of participant involvement were stated; 8) a statement of confidentiality was clearly made; and finally 9) the researchers name and contact details were made available. It was also felt that receipt of the postcard to be involved in further research was a form of written consent for being contacted and voluntarily involved in the focus groups. In the focus groups, confidentiality was emphasised.

The British Sociological Association states that “The anonymity and privacy of those who participate in the research process should be respected" (BSA 2002, p.5). As stated above, confidentiality was assured and measures were taken to safeguard electronically and physically held details of respondents.

As Bryman (2008) indicates, sometimes experiments involve making a respondent believe something which is not true, often “because researchers often want to limit participants’ understanding of what the research is about so that they respond more naturally to the experimental treatment” (p.124). While there are many degrees of deception and several approaches to the subject (Bryman 2008), however, in the research presented here, there was no form of deception intended, with the full meaning of the research was explained in advance.

Appendix I. DATA PREPARATION

In order to accurately represent data, assurances must be made that it reflects the answers given by respondents as accurately as possible. Data preparation for the research presented here involve several steps, including coding, data entry in CSPro 303 (U.S. Census Bureau *et al.* 2008), addressing missing values, importing data into SPSS 17.0 (SPSS Inc., *SPSS 17.0*), and data checking.

> "Coding is a method of representing categories and values of a variable so that: responses are converted to a form suited to statistical analysis; [and] data become more manageable by grouping similar responses" (de Vaus 2002b, p.1).

A coding scheme was decided for each question of the questionnaire, with each category represented by a number. Upon recommendation (Barahona 2009), the data entry programme CSPro, Version 3.3, was used to enter the coded data. This programme was developed by the United States Census Bureau, in conjunction with other organisations and funded by the United States Agency for International Development for the purpose of data "entry, editing, tabulation and dissemination of census and survey data" (SSC 2009, p.5). The software is free to download and is designed to minimise data entry errors. CSPro requires the researcher to create entries for each question with information such as the expected values for each entry and data skip patterns. This means that if an incorrect number (out of the range specified) is entered, the software will not record it and give a message to the person doing data entry that there was an error. Skip patterns mean that if a certain question is answered in a way in which the next question should be skipped, the software automatically does this, again reducing chance of data entry error. Though CSPro takes time to construct the data entry form, it reduces the time for data entry (as compared to SPSS) and reduces the chance of data entry error.

In the process of entering data, missing or unclear data often arises. CS Pro allows for missing data to be designated not only through coding (i.e. entering a value of 99, as was generally done in the research here), but also through a 'special' column which designates missing (and not applicable) information. All data was coded generally as it was written by the respondent. When it was unclear what a respondent was trying to designate, an educated assumption was often made by the researcher, in order to avoid missing values (Miller et al. 2002). These assumptions were always recorded in a text column that was created in CS Pro for that purpose.

There were often cases of missing data. There are several reasons why respondents may have skipped questions, deliberately not answered them, or mistakenly not

answered them. If data was missing, it was generally coded 99 (or 9). Software programmes usually deal with missing data through pairwise or listwise deletion. Data were generally excluded on a pairwise basis, meaning that if one of the specific variables (usually 2 variables) were missing a value, the test was not conducted. This is in opposition to listwise deletion, which would omit a variable if any of the variables in a list (i.e. from a respondent) were missing (Field 2005). Another method for dealing with missing data is imputation. "Imputations are *means* or *draws* from a distribution o the missing values, and require a method of creating such a distribution for the imputation based on the observed data" (Koutoumanou & Wade 2009, p.13). Imputation is a means of substituting a best estimate for a missing value, based on other values. However, imputation was not considered in the research here, as it was not felt that this would accurately represent respondents' answers. Missing data was most often missing in situations which could not be guessed or estimated. For example, a respondent may have indicated speaking to someone about walls, windows, doors and floors, but then not filled in information on whether the advice received was positive or not. Imputing this type of data would lead to false estimations. Therefore, of the two methods discussed here for addressing missing data, the former (pairwise deletion) was the method most often used.

Once all 892 questionnaires were entered into CS Pro 3.3, the data was then imported into SPSS 17.0 for processing. Data frequencies were then performed on all variables to search for anomalies in the data. There were many cases where the respondent would indicate one thing, and then go on to contradict themselves. For example, a respondent may have ticked 'no' they did not speak to anyone about walls, windows, doors and floors, but then list initials for someone with whom they spoke (i.e. fill in the name generator and name interpreters). These type of occurrences happened quite often, and in this data checking phase, many original answers (which had been entered exactly as the respondent indicated) were changed to reflect what seemed to be more accurate, as interpreted by the researcher. This particularly happened many times in the Energy Efficiency Resource Generator. All data changes are recorded. In addition, many of the missing data indications did not come through from CS Pro 3.3, so these were re-designated appropriately in SPSS 17.0. Further, the level of measurement (i.e. whether the variable was nominal, ordinal, or interval) had not been designated in CS Pro, so had to be changed by hand in SPSS 17.0. Again, each data change was recorded. At some points during data analysis, anomalies would arise again, and if changes needed to occur, these were also recorded.

Appendix J. SUMMARY STATISTICS

This appendix focuses on presenting a summary of descriptive statistics resulting from the self-completion questionnaires. The sample, which was a census of the sampling frame, was provided by a third party company and based on matched names and addresses from two primary files: the postcode address file and the edited electoral register. The initial list included all households which the third party company had information on, which is represented in column (a) of Appendix Table 15. Based on National Statistics, these numbers are quite close to those known in the 2001 Census, i.e. column (b). Questionnaires were only sent to a sample of those whose names were also attached to their address, as in column (c). The total number that responded is represented in column (d) and the final response rate for each community is represented in column (e).

Appendix Table 15: Summary of number of people in communities and response rates

Name of community	Total number of dwellings as per 3rd party company (a)	Total number of dwellings as per 2001 census (b)	Total number distributed (i.e. matched names & addresses) (c)	Total number returned (d)	Response rate (d/c)
North Leigh	800	779	364	227	62.4%
St Athan	543	518	330	186	56.4%
Alyth	1130	1401	782	479	61.3%

The response rates for each community fall generally within the estimates that are expected using the Tailored Design Method, i.e. between 50-70% (Dillman 1991).

Appendix Table 16, Appendix Table 17 and Appendix Table 18 summarise some of the basic characteristics of the respondents and details of their accommodation and length of time in their community, and, in most cases, compares the findings to statistics for the area obtained in the 2001 census. The data for column (b) in Appendix Table 15 and for the tables below were obtained from the Office of National Statistics Neighbourhood Statistics website for North Leigh[221] and St Athan,[222] and the Scottish Neighbourhood Statistics for Alyth.[223]

[221] From the Office of National Statistics Neighbourhood Statistics website (http://neighbourhood.statistics.gov.uk/), based on the Parish Profile (North Leigh CP) [Accessed 15 June 2010]

[222] From the Office of National Statistics Neighbourhood Statistics website (http://neighbourhood.statistics.gov.uk/). The St Athan data here was determined by instructing the website to aggregate 4 output areas from National Statistics (00PDNS0010, 00PDNS0009, 00PDNS0008, 00PDNS0001) which were designated by the author, based on information provided from SSE regarding street names. It misses some houses and includes some that were not in the sample, but is felt to be more accurate than Super Output Area Lower Layer 014E. [Accessed 10 August 2010]

[223] From Scottish Neighbourhood Statistics (http://www.sns.gov.uk/). The area was a specific area (S020000979) of an intermediary geography within a data zone. [Accessed 10 August 2010]

For each socio-demographic variable, significance tests were performed between each community to see if significant differences occurred between the populations; results are presented in Chapter 8. In addition, significance tests were performed between the case study findings and the national averages from the 2001 Census, where applicable. Comparing the cases with national data is essentially a test-retest method measuring reliability of each survey item, though it must be noted that the question wording and data collection mode will add error to the findings.

Communities compared to 2001 Census data

In North Leigh, there was a significant association (i.e. significant difference in expected frequencies) between the gender of respondents and the gender of community members are reported in the 2001 Census, χ^2 (1) = 4.456, p< .05, but there were no significant differences in St Athan (χ^2 (1) = 0.807, p=.38) or Alyth (χ^2 (1) = 2.355, p= .131).

The partnership status variable (i.e. living in a household that includes a couple) was only examined in St Athan, due to missing data in the other two communities. Chi-square tests yield a significant difference between the case study data and the census-determined population (χ^2 (1) = 6.173, p< .05). Examining the frequencies, it seems that those indicating a couple lives in the household are underrepresented. This also appears to be the case in North Leigh, though missing data meant that a statistical test could not be derived. Data was not available on this variable from the 2001 Census data for Alyth.

Regarding reports ownership of a dwelling and renting a dwelling, the variables collected were collapsed into either rented or owned (which includes both full ownership and ownership with a mortgage). The other variables were not included, due to low frequencies. Chi-square tests revealed a significant difference between respondents' reported ownership or rental status in the questionnaire and the reports of ownership or rental status in the 2001 Census in North Leigh (χ^2 (1) = 9.278, p< .01), St Athan (χ^2 (1) = 15.858, p< .001), and Alyth (χ^2 (1) = 27.095, p< .001). Examining the data in the tables below shows that renters were underrepresented, and owners were overrepresented, in the case communities. This is not entirely surprising, as attention to energy efficiency is often regarded (by those renting) as an issue facing the landlord, rather than the tenant (Defra 2004).

Regarding age, there was a significant difference between the frequency of respondents' reported age (by group) in the questionnaire and the ages reported in the 2001 Census in North Leigh (χ^2 (4) = 46.379, p< .001), St Athan (χ^2 (4) = 33.688, p< .001), and Alyth (χ^2 (4) = 132.11, p< .001).

Regarding education, the only village which could be compared with Census data was St Athan (given missing data in Alyth and unequal categories in North Leigh), and no significant differences arose (χ^2 (2) = 1.400, p=.497), indicating that the respondents were fairly similar to the whole population of St Athan in terms of education.

Summarising the case study versus 2001 Census findings, it appears that each community was different from the 2001 Census in terms of self-reported age and whether the respondents owned or rented their property. The same was true for gender in North Leigh, but case study respondents in St Athan and Alyth seemed to more accurately represent the male/female reports from the 2001 Census, based on the non-significance of the chi-square results. Due to missing data, comparisons of education and marital/partnership status were only possible in St Athan, and it appears that St Athan respondents were representative of the population in terms of education but not in terms of reported partnership status.

Appendix Table 16: Summary characteristics from findings and 2001 Census, North Leigh

Basic characteristics: North Leigh	**Case: North Leigh** (Total N=227)		**North Leigh 2001 census** (Dwellings N=779) (Residents N=1,919)	
Variable	N	**%**	N	**%**
Gender				
Male	97	**42.7**	974	**50.8%**
Female	127	**55.9**	945	**49.2%**
Missing	3	**1.3**		
Age (years)				
16-24	1	**0.4**	145	**7.6%**
25-44	45	**19.8**	512	**26.7%**
45-64	107	**47.1**	557	**29.0%**
65-74	35	**15.4**	178	**9.3%**
75+	36	**15.9**	153	**8.0%**
Missing	3	**1.3**		
Education				
Degree, or degree equiv, or above	85	**37.4**	469[d]	**33.7%**
Another kind of qualification	90	**39.6**	276[e]	**19.8%**
No qualifications	44	**19.4**	647[f]	**46.5%**
Missing	8	**3.5**		
Married or living as a couple				
Yes	85	**37.4**	1114	**58.1%**
No	139	**61.2**	NC[c]	**NC**
Missing	3	**1.3**		
Own or rent				
Owns outright	108	**47.6**	624[g]	**80.1%**
Owns with a mortgage or loan	89	**39.2**		
Pays part rent and part mortgage	3	**1.3**	-	-
Rents	20	**8.8**	135	**17.3%**
Lives here rent free	2	**0.9**	-	-
Missing	5	**2.2**		
Type of accommodation				
Detached house	141	**62.1**	444	**57.0%**
Semi-detached house	57	**25.1**	314[a]	**40.3%**
Terraced house	21	**9.3**		
Flat in a purpose-built block of flats or tenement	5	**2.2**	21[b]	**2.7%**
Flat that is part of a converted or shared house	1	**0.4**		
Flat in a commercial building	0	**0.0**		
A caravan or other mobile or temporary structure	0	**0.0**		
Missing	2	**0.9**		
House built				
Before 1919	27	**11.9**	-	-
Between 1919 and 1944	12	**5.3**	-	-
Between 1945 and 1964	74	**32.6**	-	-
Between 1965 and 1984	75	**33.0**	-	-
1985 or later	30	**13.2**	-	-
Don't know	6	**2.6**	-	-
Missing	3	**1.3**	-	-

[a] This includes "whole semi-detached/terraced houses/bungalows"
[b] This includes "flat maisonette or apartment; or caravan or temporary structure"
[c] NC=not certain; this only includes those over 16, so can't subtract 1114 from 1919
[d] This output from National Statistics accounts for levels 3,4 & 5; only 4&5 directly refer to degree or degree equivalent or above
[e] This output from National Statistics accounts for levels 2; levels 1, 2&3 would fully fit this category more appropriately
[f] This output from National Statistics accounts for levels 1 and below; 'below' is no qualifications
[g] Covers ownership, does not distinguish if owned outright or owned with mortgage

Appendix Table 17: Summary characteristics from findings and 2001 Census, St Athan

Basic characteristics: St Athan	Case: St Athan (Total N=186)		St Athan 2001 census[a] (Dwellings N=518) (Residents N=1,155)	
Variable	N	**%**	N	**%**
Gender				
Male	81	**43.5**	566	**48.3%**
Female	100	**53.8**	605	**51.7%**
Missing	5	**2.7**		
Age (years)				
16-24	3	**1.6**	115	**12.1**
25-44	34	**18.3**	271	**28.4**
45-64	81	**43.5**	286	**30.0**
65-74	28	**15.1**	130	**13.6**
75+	38	**20.4**	151	**15.8**
Missing	2	**1.1**		
Education				
Degree, or degree equiv, or above	20	**10.8**	69	**8.6**
Another kind of qualification	93	**50.0**	443	**55.2[b]**
No qualifications	67	**36.0**	291	**36.2**
Missing	6	**3.2**		
Married or living as a couple				
Yes	94	**50.5**	556	**62.1**
No	86	**46.2**	345	**37.9**
Missing	6	**3.2**		
Own or rent				
Owns outright	70	**37.6**	184	**29.0**
Owns with a mortgage or loan	60	**32.3**	179	**28.2**
Pays part rent and part mortgage	0	**0**	0	**0.0**
Rents	45	**25.6**	266	**41.9**
Lives here rent free	1	**0.6**	6	**0.9**
Missing	10			
Type of accommodation				
Detached house	47	**25.3**	320	**28.3**
Semi-detached house	81	**43.5**	490	**43.4**
Terraced house	41	**22.0**	183	**16.2**
Flat in a purpose-built block of flats or tenement	14	**7.5**	56	**5.0**
Flat that is part of a converted or shared house	0	**0**	6	**0.5**
Flat in a commercial building	0	**0**	6	**0.5**
A caravan or other mobile or temporary structure	0	**0**	68	**6.0**
Missing	3	**1.6**		
House built				
Before 1919	9	**4.8**	-	-
Between 1919 and 1944	31	**16.7**	-	-
Between 1945 and 1964	78	**41.9**	-	-
Between 1965 and 1984	45	**24.2**	-	-
1985 or later	15	**8.1**	-	-
Don't know	6	**3.2**	-	-
Missing	2	**1.1**	-	-

[a] Based on 4 output areas: 00PDNS0010, 00PDNS0001, 00PDNS0009, 00PDNS0008. National Statistics cautions that "using statistics from different sets of data means that you may not be comparing like with like"

[b] This output from National Statistics accounts for levels 1,2 & 3 as well as an 'other' category

Appendix Table 18: Summary characteristics from findings and 2001 Census, Alyth

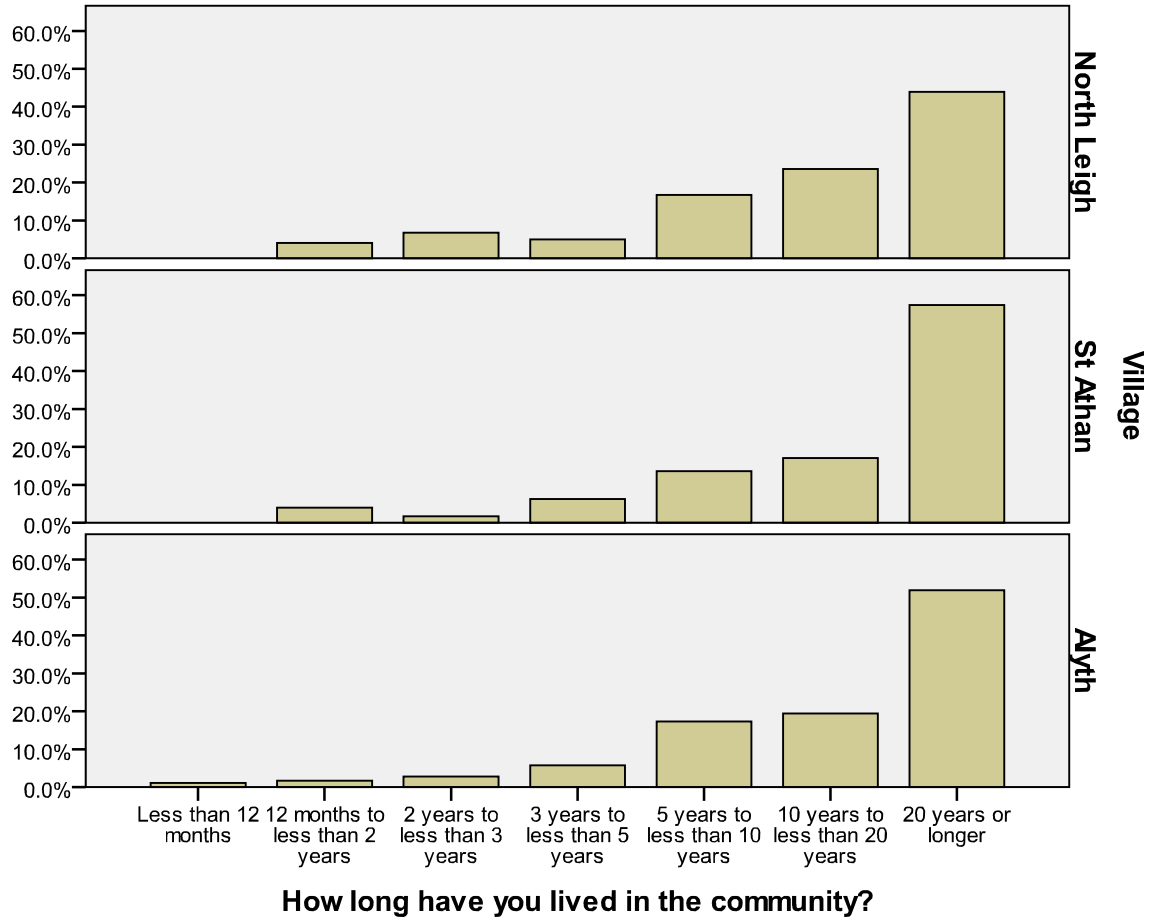
Basic characteristics: Alyth	**Case: Alyth** (Total N=479)		**Alyth 2001 census**[a] (Dwellings N=1,401) (Residents N=4,776)	
Variable	N	**%**	N	**%**
Gender				
Male	199	**41.5**	1302	**46.9**
Female	263	**54.9**	1473	**53.1**
Missing	17	**3.5**		
Age (years)				
16-24	1	**0.2**	267	**11.8**[b]
25-44	87	**18.2**	731	**32.2**
45-64	183	**38.2**	742	**32.7**
65-74	109	**22.8**	293	**12.9**
75+	87	**18.2**	237	**10.4**
Missing	12	**2.5**		
Education				
Degree, or degree equiv, or above	117	**24.4**	-[c]	-[c]
Another kind of qualification	181	**37.8**	-[c]	-[c]
No qualifications	156	**32.6**	-[c]	-[c]
Missing	25	**5.2**		
Married or living as a couple				
Yes	227	**47.4**	-[c]	-[c]
No	234	**48.9**	-[c]	-[c]
Missing	18	**3.8**		
Own or rent				
Owns outright	209	**43.6**	384	**31.4**
Owns with a mortgage or loan	134	**28.0**	393	**32.2**
Pays part rent and part mortgage	4	**0.8**	5	**0.4**
Rents	100	**20.9**	439	**36.0**
Lives here rent free	10	**2.1**	-[c]	-[c]
Missing	22	**4.6**		
Type of accommodation				
Detached house	175	**36.5**	516	**36.9**[d]
Semi-detached house	116	**24.2**	274	**19.6**[d]
Terraced house	107	**22.3**	321	**22.9**[d]
Flat in a purpose-built block of flats or tenement	37	**7.7**	289	**20.6**[d,e]
Flat that is part of a converted or shared house	20	**4.2**		
Flat in a commercial building	5	**1.0**		
A caravan or other mobile or temporary structure	0	**0.0**	-[c]	-[c]
Missing	19	**4.0**		
House built				
Before 1919	134	**28.0**	-	-
Between 1919 and 1944	52	**10.9**	-	-
Between 1945 and 1964	51	**10.6**	-	-
Between 1965 and 1984	108	**22.5**	-	-
1985 or later	105	**21.9**	-	-
Don't know	12	**2.5**	-	-
Missing	17	**3.5**	-	-

[a] Most data is from the 2001 Census, except regarding types of accommodation (which are based on 2009 figures)
[b] This also includes 15 year olds, as the data was already aggregated to include that age group
[c] Not available
[d] Data from 2009
[e] This variable was not divided into the sub-categories, but instead includes all 'flats'

Length of time lived in community

The first question in the 'Energy Efficiency in your Community' questionnaire addressed aspects of the community in which the person resided. The first question (Q1) asked *How long have you lived in North Leigh?* The percentage of responses is presented in Appendix Figure 12.

Appendix Figure 12: Length of time (percentage) respondents indicated living in their community



Mann-Whitney tests revealed that there was a significant difference between the time in which North Leigh respondents indicated living in their community as compared to St Athan (U=16844.0, p<.05) and Alyth (U=47212.0, p<.05), but not between St Athan and Alyth (U=39186.5, p=.299). It appears that the difference originates from the fact that a slightly higher percentage of residents in St Athan (57.4%) and Alyth (51.9%) indicated living in their community for 20 years or more, as compared to North Leigh (43.9%). Though not meant to be representative of the population communities, the focus group respondents reflected fairly similar findings: slightly fewer respondents in

North Leigh indicated living in North Leigh for 20 years or more (37.5%), as compared to St Athan (57%) and Alyth (50%).[224]

Satisfaction with community (Q2) is discussed in Chapter 8. A crosstabulation was conducted on the variables of Q1 and Q2, but even after recoding to account for insufficient expected frequencies, there were no significant associations between the two variables in any village.

Energy programme awareness

On the first page of the questionnaire, there were two questions posed to gather awareness information. The first question on awareness was related to the local programme: *Q3:Would you say you are aware of the [insert name of programme] project which has been running since [insert start date]?*. The responses were overwhelmingly positive, with 91% of North Leigh respondents indicating they were aware of the 'Challenge North Leigh' programme and 88% of Alyth residents reporting they were aware of 'Alyth Energy Challenge'. There were moderate levels of awareness in St Athan, with 57% of respondents indicating they were aware of the 'Get Smart with St Athan' programme, as described in Appendix Table 19.

Appendix Table 19: Were you aware of the programme in your community? Percent (frequency)

	Yes	No	DK	Missing
North Leigh	90.7% (206)	5.7% (13)	1.8% (4)	1.8% (4)
St Athan	56.5% (105)	31.7% (59)	4.8% (9)	7% (13)
Alyth	87.9% (421)	7.9% (38)	1.5% (7)	2.7% (13)

North Leigh and Alyth were similar in terms of the percentage of respondents aware of the local energy efficiency programme (90.7% and 87.9%, respectively), as demonstrated through a non-significant Mann-Whitney test (χ^2 (1) = 1.169, p= .279)[225]. However, only 56.5% of St Athan respondents indicated awareness of the 'Get Smart' programme, which was significantly different from both North Leigh (χ^2 (1) = 55.435, p< .001) and Alyth (χ^2 (1) = 70.509, p< .001).

In order to investigate associations with other answers, a number of crosstabulations were performed with awareness, which resulted in chi-square tests as in Appendix Table 20.

[224] An inadvertent diversion from the focus group script meant that length of time in the village was not asked in the 'Alyth Energy Challenge' group, so the percentage is based on the local resident's focus group. As well, this includes one person in St Athan who did not live directly in the village, but lived extremely close, and was thus included.
[225] Chi-square test was conducted in Excel.

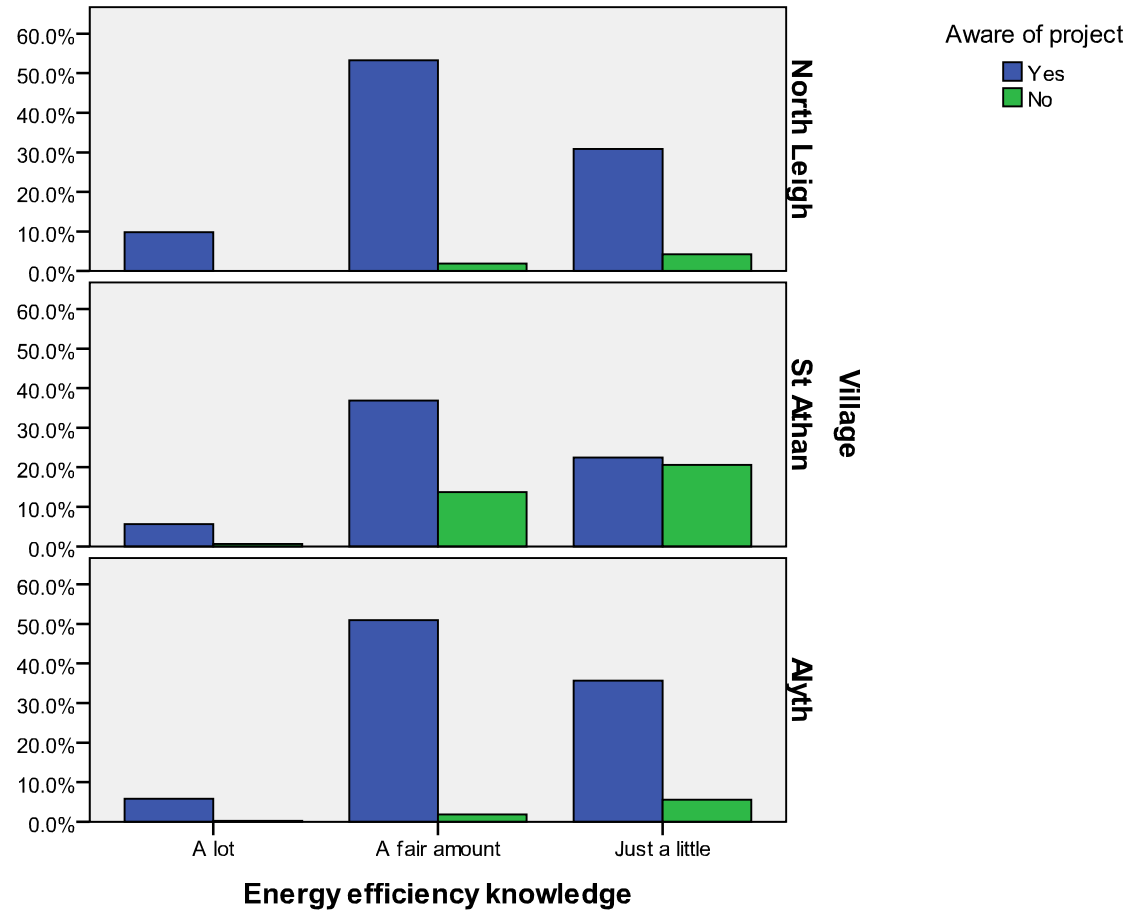
Appendix Table 20: Chi-square results of programme awareness (Q3) with other variables, in each community

	North Leigh			St Athan			Alyth		
	χ^2	*df*	Sig	χ^2	*df*	Sig	χ^2	*df*	Sig
Education	2.103	2	0.349	0.114	2	0.945	5.139	2	0.077
Energy knowledge[a]	7.464	2	0.024[b]	9.925	2	0.007**	14.66	2	0.001**
How long lived in village[c]	5.415	3	0.144	3.418	3	0.331	6.008	3	0.111
Male / Female	0.624	1	0.429	0.221	1	0.638	1.854	1	0.173
Age of respondent[e]	3.843	2	0.146[b]	0.277	2	0.871	1.357	2	0.507
Own or rent accommodation[f]	0.031	1	0.859[b]	1.575	1	0.209	2.444	1	0.118

**p<.01
[a] Only compares 'a lot', 'a fair amount' & 'just a little' answer categories, as counts were too low in other categories for a valid model
[b] Expected frequencies are less than 5 in more than 20% of cells, model is invalid
[c] Recoded to collapse lower ranges into '5 years or less'
[e] Recoded into three categories: 16-44, 45-64, 65+
[f] Recoded into own (outright or with mortgage or partial) and rent (rent or lives rent free)

The only significant associations occurred in St Athan and Alyth on the question, *Q6:* "*How much, in anything, would you say you know about energy efficiency?"* The results from North Leigh, though they appear significant (p<.05), had an expected frequency of less than 5 in more than 20% of cells, which violates principles of the test (Field 2005). Appendix Figure 13 describes the results of the cross-tabulations in graphical form. The results indicate that those who know 'just a little' are less likely to say 'yes' they are aware and more likely to say 'no' they are not aware.

Appendix Figure 13: Energy efficiency knowledge (re-coded) and awareness of project



The second awareness question asks about discussions of the programme: *Q4: Have you discussed or talked about anything concerning the [name of programme] with anyone?* There was a skip pattern in the questionnaire, so this question was meant to be answered by those in the 'yes' category of Question 3. The results in Appendix Table 21 indicate that, assuming the respondent was aware of the project: more people spoke to others about it than not in North Leigh; less people spoke to others about it than did not in St Athan; and exactly the same number of people spoke about it or did not speak about it in Alyth.

Appendix Table 21: Discuss programme with anyone? (Q4) Percent (frequency)

	Yes	No	DK	Missing
North Leigh	55.2% (117)	41.5% (88)	0.9% (2)	2.4% (5)
St Athan	36.7% (47)	55.5% (71)	3.1% (4)	4.7% (6)
Alyth	48.3% (215)	48.3% (215)	0.7% (3)	2.7% (12)

As this question was very general, and did not specifically ask if the respondent sought information (rather, just talked about it), this is not considered mobilised 'energy social

capital' necessarily. However, the results are compared to the frequency of mobilisation of 'energy social capital' below.

Knowledge of energy efficiency

In the pre-test, there were indications that respondents might not seek information from others, i.e. they would indicate 'no' in all or most of the Energy Efficiency Resource Generator questions asking *'do you know anyone who ....'* could give a form of advice. The reason offered was that the respondents either knew the information themselves, or were not certain that others would offer 'sound' advice. Question 6 was therefore compared to the aggregate of answers in the Energy Efficiency Resource Generator, testing the hypothesis that as energy efficiency knowledge *increases*, the number of people considered to have sources of energy efficiency information or advice *decreases*. Access to energy advice was measured using twelve questions with a dichotomous answer, yes (1) or no (0). A new variable was created by adding up the number of 'yes' answers to the twelve questions, yielding answers that ranged from 0 to 12. A Kolmogorov-Smirnov tests indicated that none of the populations were normally distributed (North Leigh: $D(227)=0.119$, $p<.001$; St Athan: $D(186)=0.147$, $p<.001$; Alyth: $D(479)=0.119$, $p<.001$). As the independent variable (energy efficiency knowledge) is ordinal, and the dependent variable (Energy Efficiency Resource Generator sum) is a non-normal interval variable, and the purpose is to determine if there is any correlation between the two, a rank correlation is tested using Spearman's rho (ρ). This is a non-parametric test which assigns a rank to each value to data and then applies Pearson's equation, as explained in Chapter 8. The results of the Spearman's tests indicated significant results (North Leigh: $r_s= -0.314$, $p<.001$; St Athan: $r_s = -0.199$, $p<.05$; Alyth, $r_s = -0.202$, $p<.001$), but the negative r_s values indicate that respondents who report *lower* levels of energy efficiency knowledge are able to access *fewer* people for advice or information; conversely, this means that respondents who reported higher levels of energy efficiency knowledge tended to be able to access information from *more* people. This was consistent across all three communities, and appears to be in contrast to the findings from the pre-test, which suggested that people might consider themselves so knowledgeable that they would not think to approach anyone for information, were self-sufficient in knowledge, or did not trust the answers from others. However, these findings may also indicate that self-reported knowledge was actually *gained* from the people referred to in the Energy Efficiency Resource Generator. As previously stated, Darley & Beniger (1981) and Ball et al. (1999) indicate but personal communication can be more influential than media for adoption of energy efficiency measures. According to Rogers (2003), those in the latter stages of the innovation-decision process are more likely to hold knowledge of the innovation.

Therefore, given the breadth of time which the questionnaire covered (i.e. almost two years), it could be that respondents indicated being able to approach people for information based on previous experience. However, given that programme awareness was not related to the number of people with whom respondents mobilised 'energy social capital', inferences are unclear. Further research would be needed to more fully understand the relation between Q6 and the Energy Efficiency Resource Generator.

Innovations

There were several types of energy-reducing innovations that were included in the questionnaire. The decision of which innovations to include was an iterative process which involved researching measures that are being encouraged by the Government, by SSE and by the community groups. The measures were grouped in an iterative process, as well; the groups were not based on any other standards, but simply in a way that was hoped to make sense to the respondent. The four groups were:

Walls, windows, doors and floors (referred to as 'WWDF' here)
Visual displays of energy use (referred to as 'Visual displays' here)
Appliances, heating & lighting (referred to as 'AHL' here)
The way we act in the house (referred to as 'Behave' here)

Data was gathered from respondents by inquiring as to the stage of their process in the innovation-decision process. These stages were developed through an iterative process, attempting to match reasonable questions to each phase of the innovation-decision process. The questions were adapted to the innovation category. The walls, windows, doors and floors (WWDF) and appliances heating and lighting (AHL) categories were very similar, mainly in that they addressed established types of energy-reducing innovations. Appendix Table 22 describes the indicator (i.e. the answer categories from which respondents were asked to choose) and the associated stage of the innovation-decision process for WWDF and AHL.

Appendix Table 22: The indicators in the questionnaire which applied to each stage of the innovation-decision process for WWDF and AHL innovations

Stage of Innovation-Decision process	Indicator
Knowledge (or pre-Knowledge)	Did not consider
Persuasion	Considered and still deciding
Decision	Planning to order & install (Adoption)
	Considered but decided against (Rejection)
Implementation	Have ordered it, waiting for installation
Implementation / Confirmation	Installed after [date of interventions]
	Installed before [date of interventions]

There were nine innovations in the WWDF category: four types of insulation (cavity wall, solid wall, loft and floor); three types of draughtproofing (door, window and the use

of heavy curtains); and two types of window glazing (double and secondary). The summary of WWDF responses is presented for each village in Appendix Table 23.

Appendix Table 23: 'Walls, windows, doors and floors' innovations according to innovation-decision indicator, frequencies (percents)

	Insulation				Draughtproofing			Window glazing	
	Cavity wall	Solid wall	Loft	Floor	Door	Window	Heavy curtains	Double	Secon-dary
North Leigh (N=227)									
Installed [before date]	103 (45.4%)	23 (10.1%)	142 (62.6%)	21 (9.3%)	73 (32.2%)	75 (33%)	94 (41.4%)	182 (80.2%)	17 (7.5%)
Installed [after date]	22 (9.7%)	5 (2.2%)	28 (12.3%)	8 (3.5%)	14 (6.2%)	10 (4.4%)	17 (7.5%)	20 (8.8%)	2 (0.9%)
Ordered it	3 (1.3%)	-	5 (2.2%)	2 (0.9%)	1 (0.4%)	1 (0.4%)	1 (0.4%)	1 (0.4%)	-
Planning to order	2 (0.9%)	-	7 (3.1%)	-	5 (2.2%)	3 (1.3%)	2 (0.1%)	-	-
Still deciding	9 (4.0%)	2 (0.9%)	10 (4.4%)	2 (0.9%)	9 (4.0%)	4 (1.8%)	19 (8.4%)	2 (0.9%)	-
Decided against	6 (2.6%)	3 (1.3%)	2 (0.9%)	3 (1.3%)	-	1 (0.4%)	6 (2.6%)	1 (0.4%)	6 (2.6%)
Did not consider	29 (12.8%)	58 (25.6%)	8 (3.5%)	82 (36.1%)	63 (27.8%)	57 (25.1%)	50 (22%)	4 (1.8%)	37 (16.3%)
N/A	*37 (16.3%)*	*96 (42.3%)*	*15 (6.6%)*	*76 (33.5%)*	*37 (16.3%)*	*50 (22%)*	*21 (9.3%)*	*11 (4.8%)*	*116 (51.1%)*
Missing	*16 (7.0%)*	*40 (17.6%)*	*10 (4.4%)*	*33 (14.5%)*	*25 (11%)*	*26 (11.5%)*	*17 (7.5%)*	*6 (2.6%)*	*49 (21.6%)*
St Athan (N=186)									
Installed [before date]	73 (39.2%)	9 (4.8%)	114 (61.3%)	6 (3.2%)	60 (32.3%)	55 (29.6%)	66 (35.5%)	144 (77.4%)	8 (4.3%)
Installed [after date]	27 (14.5%)	5 (2.7%)	19 (10.2%)	-	7 (3.8%)	6 (3.2%)	12 (6.5%)	11 (5.9%)	-
Ordered it	2 (1.1%)	3 (1.6%)	3 (1.6%)	-	-	-	-	1 (0.5%)	-
Planning to order	4 (2.2%)	-	4 (2.2%)	-	1 (0.5%)	2 (1.1%)	1 (.05%)	3 (1.6%)	-
Still deciding	11 (5.9%)	3 (1.6%)	5 (2.7%)	3 (1.6%)	7 (3.8%)	10 (5.4%)	7 (3.8%)	1 (0.5%)	1 (0.5%)
Decided against	13 (7.0%)	3 (1.6%)	1 (0.5%)	4 (2.2%)	-	-	2 (1.1%)	-	-
Did not consider	19 (10.2%)	50 (26.9%)	15 (8.1%)	59 (31.7%)	40 (21.5%)	37 (19.9%)	44 (23.7%)	9 (4.8%)	32 (17.2%)
N/A	*20 (10.8%)*	*56 (32.3%)*	*12 (6.5%)*	*60 (32.3%)*	*28 (15.1%)*	*30 (16.1%)*	*22 (11.8%)*	*6 (3.2%)*	*85 (45.7%)*
Missing	*17 (9.1%)*	*60 (32.3%)*	*13 (13.4%)*	*54 (29.0%)*	*43 (23.1%)*	*46 (24.7%)*	*32 (17.2%)*	*11 (5.9%)*	*60 (32.3%)*
Alyth (N=479)									
Installed [before date]	120 (25.1%)	53 (11.1%)	300 (62.6%)	68 (14.2%)	180 (37.6%)	178 (37.2%)	197 (41.1%)	343 (71.6%)	23 (4.8%)
Installed [after date]	7 (1.5%)	7 (1.5%)	50 (10.4%)	13 (2.7%)	26 (5.4%)	23 (4.8%)	38 (7.9%)	45 (9.4%)	1 (0.2%)
Ordered it	-	-		1 (0.2%)	4 (0.8%)	2 (0.4%)	2 (0.4%)	1 (0.2%)	1 (0.2%)
Planning to order	1 (0.2%)	1 (0.2%)	9 (1.9%)	-	10 (2.1%)	2 (0.4%)	5 (1.0%)	-	-
Still deciding	23 (4.8%)	13 (2.7%)	13 (2.7%)	11 (2.3%)	26 (5.4%)	14 (2.9%)	28 (5.8%)	8 (1.7%)	3 (0.6%)
Decided against	9 (1.9%)	7 (1.5%)	3 (0.6%)	8 (1.7%)	4 (0.8%)	3 (0.6%)	7 (1.5%)	10 (2.1%)	5 (1.0%)
Did not consider	61 (12.7%)	94 (19.6%)	14 (2.9%)	148 (30.9%)	83 (17.3%)	74 (15.4%)	70 (14.6%)	11 (2.3%)	52 (10.9%)
N/A	*179 (37.4%)*	*185 (38.6%)*	*56 (11.7%)*	*130 (27.1%)*	*76 (15.9%)*	*101 (21.1%)*	*72 (15.0%)*	*36 (7.5%)*	*271 (56.6%)*
Missing	*79 (16.5%)*	*119 (24.8%)*	*34 (7.1%)*	*100 (20.9%)*	*70 (14.6%)*	*82 (17.1%)*	*60 (12.5%)*	*25 (5.2%)*	*123 (25.7%)*

There are a few points to note from Appendix Table 23. Firstly, there are many blanks in the intermediary stages of the innovation-decision process. This immediately calls

into question the content validity of the answer category construction. In this case, it may be that the innovation-decision stage was overcompensated for in the question and answer category design. As discussed below, the categories were ultimately not used, as no statistical (conclusion) validity could be found. Secondly, there are two innovations which a large percentage of respondents indicated had been implemented before the SSE intervention. Even accounting for missing data, over 60% of respondents reported having installed loft insulation (62.6% in North Leigh; 61.3% in St Athan; 62.6% in Alyth) and over 70% had installed double-glazed windows (80.2% in North Leigh; 77.4% in St Athan; 71.6% in Alyth).

There were five innovations in the AHL category: three dealing with heating (heating upgrades, heating controls and radiator reflectors); one regarding A-rated appliances, and another regarding low-energy lighting. The summary of AHL answers (percentage) for each innovation is presented for each community in Appendix Table 24.

Appendix Table 24: 'Appliances, heating and lighting' innovations according to each indicator of the innovation-decision process, frequencies (percent)

AHL Innovations	**Heating**			**Appliances**	**Lighting**
	Heating upgrade	Heating controls	Radiator reflectors	A-rated	Low-energy bulbs
North Leigh					
Installed [before date]	119 (49.8%)	117 (51.5%%)	19 (8.4%)	71 (31.3%)	66 (29.1%%)
Installed [after date]	24 (10.6%)	28 (12.3%)	6 (2.6%)	48 (21.1%)	116 (51.1%)
Ordered it	5 (2.2%)	2 (0.9%)	2 (0.9%)	3 (1.3%)	-
Planning to order	5 (2.2%)	5 (2.2%)	2 (0.9%)	9 (4.0%)	8 (3.5%)
Still deciding	13 (5.7%)	5 (2.2%)	9 (4.0%)	8 (3.5%)	14 (6.2%)
Decided against	10 (4.4%)	4 (1.8%)	8 (3.5%)	5 (2.7%)	4 (1.8%)
Did not consider	26 (11.5%)	26 (11.5%)	114 (50.2%)	43 (18.9%)	7 (3.1%)
N/A	17 (7.5%)	21 (9.3%)	28 (12.3%)	19 (8.4%)	4 (1.8%)
Missing	14 (6.2%)	40 (17.6%)	39 (17.2%)	21 (9.3%)	8 (3.5%)
St Athan					
Installed [before date]	83 (44.6%)	83 (44.6%)	14 (7.5%)	58 (31.2%)	87 (46.8%)
Installed [after date]	27 (14.5%)	21 911.3%)	4 (2.2%)	30 (16.1%)	61 (32.8%)
Ordered it	1 (0.5%)	1 (0.5%)	-	1 (0.5%)	0.51 (%)
Planning to order	1 (0.5%)	1.63 (%)	2 (1.1%)	5 (2.7%)	9 (4.8%)
Still deciding	6 (3.2%)	4 (2.2%)	4 (2.2%)	12 (6.5%)	3 (1.6%)
Decided against	4 (2.2%)	2 (1.1%)	7 (3.8%)	3 (1.6%)	2 (1.1%)
Did not consider	32 (17.2%)	31 (16.7%)	87 (46.8%)	32 (17.2%)	9 (4.8%)
N/A	13 (7.0%)	17 (9.1%)	25 (13.4%)	11 (5.9%)	4 (2.2%)
Missing	19 (10.2%)	24 (12.9%)	43 (23.1%)	45 (18.3%)	10 (5.4%)
Alyth					
Installed [before date]	235 (49.1%)	252 (52.6%)	51 (10.6%)	170 (35.5%)	196 (40.9%)
Installed [after date]	69 (14.4%)	51 (10.6%)	10 (2.1%)	94 (19.6%)	191)39.9%
Ordered it	2 (0.4%)	2 (0.4%)	2 (0.4%)	1 (0.2%)	2 (0.4%)
Planning to order	6 (1.3%)	3 (0.6%)	5 (1.0%)	20 (4.2%)	21 (2.5%)
Still deciding	23 (4.8%)	8 (1.7%)	28 (5.8%)	19 (4.0%)	17 (3.5%)
Decided against	13 (2.7%)	3 (0.6%)	7 (1.5%)	7 (1.5%)	15 (3.1%)
Did not consider	45 (9.4%)	45 (9.4%)	187 (39.0%)	66 (13.8%)	16 (3.3%)
N/A	48 (10.0%)	57 (1.9%)	94 (19.6%)	7.134 (%)	12 (2.5%)
Missing	38 (7.9%)	58 (12.1%)	95 (19.8%)	68 (14.2%)	18 (3.8%)

In Appendix Table 24, there are few missing categories, but frequencies were still quite low for the 'middle' stages of the innovation-decision process. The most popular innovations were heating upgrades and heating controls, which half of respondents had adopted before the intervention in both North Leigh (49.8% and 51.5%, respectively) and Alyth (49.1% and 52.6%, respectively), and slightly less in St Athan (44.6% for both innovations). In St Athan, almost half of respondents had adopted the innovation of low-energy lights before the interventions (46.8%), while over half (51.1%) adopted them *after* the intervention in North Leigh. The innovation which was considered the least in all three communities was radiator reflectors (50.2% did not consider in North Leigh; 46.8% did not consider in St Athan; and 39% did not consider in Alyth).

The innovation category 'Visual displays' consisted of three innovations which were all specific to the SSE or other recent interventions in each village: smart meters, current cost monitors and thermal imaging. As it was assumed at the time of implementing the research here that each was implemented by SSE, there were no assumptions made that the respondent would have done it before a certain date. And particularly in the case of current cost meters, and the visual display of the smart meters, which both require attention and are thus more a type of behavioural innovation, there was no assumption that once they were implemented they would continue to be used. Therefore, slightly different answer categories were designated, as in Appendix Table 25.

Appendix Table 25: The indicators in the questionnaire which applied to each stage of the innovation-decision process for Visual innovations

Stage of Innovation-Decision process	Indicator
Knowledge (or pre-Knowledge)	Did not consider
Persuasion	Considered and still deciding
Decision	Planning to order & install (Adoption)
	Considered but decided against (Rejection)
Implementation	Have ordered it, waiting for installation
Implementation – confirmation	Is now installed or already did
Implementation – rejection	Already installed, but stopped using

Appendix Table 26 summarises the responses (percentages) for 'Visual displays'.

Appendix Table 26: 'Visual' innovations according to each indicator of the innovation-decision process, frequencies (percent)

Visual display innovations	Smart meter	Current cost monitor	Infrared thermal imaging
North Leigh			
Is installed / was done	49 (21.6%)	85 (37.4%)	17 (7.5%)
Installed, but stopped using	16 (7.0%)	26 (11.5%)	n/a
Ordered it	7 (3.1%)	5 (2.2%)	-
Planning to order	8 (3.5%)	1 (0.4%)	-
Still deciding	14 (6.2%)	9 (4.0%)	6 (2.6%)
Decided against	8 (3.5%)	4 (1.8%)	3 (1.3%)
Did not consider	88 (38.8%)	66 (29.1%)	141 (62.1%)
N/A	11 (4.8%)	9 (4.0%)	20 (8.8%)
Missing	26 (11.5%)	22 (9.7%)	40 (17.6%)
St Athan			
Is installed / was done	41 (22.0%)	30 (16.1%)	1 (0.5%)
Installed, but stopped using	9 (4.8%)	5 (2.7%)	n/a
Ordered it	-	-	-
Planning to order	4 (2.2%)	-	1 (0.5%)
Still deciding	16 (8.6%)	8 (4.3%)	5 (2.7%)
Decided against	5 (2.7%)	2 (1.1%)	2 (1.1%)
Did not consider	64 (34.4%)	84 (45.2%)	114 (61.3%)
N/A	17 (9.1%)	22 (11.8%)	25 (13.4%)
Missing	30 (16.1%)	57 (18.8%)	38 (20.4%)
Alyth			
Is installed / was done	82 (17.1%)	63 (13.2%)	5 (1.0%)
Installed, but stopped using	23 (4.8%)	15 (3.1%)	n/a
Ordered it	8 (1.7%)	2 (0.4%)	1 (0.2%)
Planning to order	20 (4.2%)	9 (1.9%)	2 (0.4%)
Still deciding	46 (9.6%)	25 (5.2%)	13 (2.7%)
Decided against	15 (3.1%)	7 (1.5%)	7 (1.5%)
Did not consider	175 (36.5%)	209 (43.6%)	281 (58.7%)
N/A	54 (11.3%)	57 (11.9%)	62 (12.9%)
Missing	56 (11.7%)	92 (19.2%)	108 (22.5%)

Approximately one-fifth of respondents indicated adopting smart meters and continuing to use them (North Leigh: 21.6%; St Athan: 22%; Alyth 17.1%). Adoption of current cost monitors appeared to have differed with each community; far more people indicated adopting them and continuing to use them in North Leigh (37.4%) than in St Athan (16.1%) or Alyth (13.2%). The majority of people in each village had not considered infrared thermal imaging.

The last category of innovations involved behaviour or actions in the house, i.e. 'Behave'. Behave could not be tested in the same way as technical innovations, as they necessarily involve continuous actions, rather than the normal one-time installations which were generally referred to above. After consultation with colleagues and pre-test trials, it was decided to focus on behavioural change by asking respondents to indicate how often they performed an energy-reducing action, both before the SSE intervention and afterwards (i.e. at the time they received the questionnaire). Seven behavioural innovations were listed, and respondents were asked to indicate how often they performed each. The innovations were: turning items off standby; only filling the kettle with enough water as was needed; drawing the

curtains at night when it is cold; using heating controls; turning lights off when they are not needed; turning electric items off over night when they are not used; and turning heating off in rooms which are not used. Appendix Table 27 summarises the responses for each community.

Appendix Table 27: 'Behave' innovations at two time points, frequencies (percent)

	All the time	Most of the time	Half the time	Some of the time	Never	N/A	Missing
North Leigh: At time of filling out questionnaire (i.e. in the last 7 days)							
Standby	78 (34.4%)	97 (42.7%)	9 (4.0%)	30 (13.2%)	11 (4.8%)	1 (0.4%)	1 (0.4%)
Kettle	95 (41.9%)	76 (33.5%)	17 (7.5%)	29 (12.8%)	8 (3.5%)	1 (0.4%)	1 (0.4%)
Drew curtains	160 (70.5%)	40 (17.6%)	2 (0.9%)	8 (3.5%)	11 (4.8%)	4 (1.8%)	2 (0.9%)
Heating controls	137 (60.4%)	30 (13.2%)	3 (1.3%)	15 (6.6%)	10 (4.4%)	24(10.6%)	8 (3.5%)
Lights off	147 (64.8%)	65 (28.6%)	5 (2.2%)	6 (2.6%)	1 (0.4%)	-	3 (1.3%)
Electrical off	147 (4.8%)	44 (19.4%)	5 (2.2%)	15 (6.6%)	7 (3.1%)	5 (2.2%)	4 (1.8%)
Heating off	68 (30.0%)	38 (16.7%)	8 (3.5%)	30 (13.2%)	49 (21.6%)	28(12.3%)	6 (2.6%)
North Leigh: Before the SSE programme began							
Standby	49 (21.6%)	75 (33.0%)	15 (6.6%)	56 (24.7%)	26 (11.5%)	3 (1.3%)	3 (1.3%)
Kettle	55 (24.2%)	57 (25.1%)	30 (13.2%)	59 (26.0%)	20 (8.8%)	4 (1.8%)	2 (0.9%)
Drew curtains	133 (58.6%)	46 (20.3%)	7 (3.1%)	18 (7.9%)	14 (6.2%)	4 (1.8%)	5 (2.2%)
Heating controls	111 (48.9%)	40 (17.6%)	13 (5.7%)	19 (8.4%)	18 (7.9%)	21 (9.3%)	5 (2.2%)
Lights off	110 (48.5%)	74 (32.6%)	21 (9.3%)	14 (6.2%)	3 (1.3%)	2 (0.9%)	3 (1.3%)
Electrical off	102 (44.9%)	53 (23.3%)	18 (7.9%)	20 (8.8%)	18 (7.9%)	8 (3.5%)	8 (3.5%)
Heating off	59 (26.0%)	33 (14.5%)	14 (6.2%)	36 (15.9%)	58 (25.6%)	23 (10.1%)	4 (1.8%)
St Athan: At time of filling out questionnaire (i.e. in the last 7 days)							
Standby	94 (50.5%)	52 (28.0%)	8 (4.3%)	15 (8.1%)	11 (5.9%)	1 (0.5%)	5 (2.7%)
Kettle	83 (44.6%)	60 (32.3%)	10 (5.4%)	17 (9.1%)	10 (5.4%)	1 (0.5%)	5 (2.7%)
Drew curtains	110 (59.1%)	30 (16.1%)	8 (4.3%)	11 (5.9%)	17 (9.1%)	6 (3.2%)	4 (2.2%)
Heating controls	111 (59.7%)	28 (15.1%)	2 (1.1%)	10 (5.4%)	14 (7.5%)	14 (7.5%)	7 (3.8%)
Lights off	142 (76.3%)	31 (16.7%)	2 (1.1%)	7 (3.8%)	1 (0.5%)	-	3 (1.6%)
Electrical off	129 (69.4%)	15 (8.1%)	4 (2.2%)	11 (5.9%)	5 (2.7%)	13 (7.0%)	9 (4.8%)
Heating off	74 (39.8%)	24 (12.9%)	5 (2.7%)	21 (11.3%)	43 23.1%)	12 (6.5%)	7 (3.8%)
St Athan: Before the SSE programme began							
Standby	71 (38.2%)	50 (26.9%)	8 (4.3%)	27 (14.5%)	17 (9.1%)	1 (0.5%)	12 (6.5%)
Kettle	64 (34.4%)	52 (28.0%)	18 (9.7%)	29 (15.6%)	13 (7.0%)	1 (0.5%)	9 (4.8%)
Drew curtains	96 (51.6%)	35 (18.8%)	3 (1.6%)	15 (8.1%)	17 (9.1%)	6 (3.2%)	14 (7.5%)
Heating controls	93 (50.0%)	27 (14.5%)	6 (3.2%)	14 (7.5%)	19 (10.2%)	13 (7.0%)	14 (7.5%)
Lights off	116 (62.4%)	39 (21.0%)	4 (2.2%)	14 (7.5%)	4 (1.6%)	1 (0.5%)	9 (4.8%)
Electrical off	100 (53.8%)	27 (14.5%)	8 (4.3%)	14 (7.5%)	11 (5.9%)	15 (8.1%)	11 (5.9%)
Heating off	62 (33.3%)	26 (14.0%)	6 (3.2%)	23 (12.4%)	43 (23.1%)	11 (5.9%)	15 (8.1%)
Alyth: At time of filling out questionnaire (i.e. in the last 7 days)							
Standby	222 (46.3%)	148 (30.9%)	15 (3.1%)	63 (13.2%)	15 (3.1%)	2 (0.4%)	14 (2.9%)
Kettle	216 (45.1%)	165 (34.4%)	25 (5.2%)	47 (9.8%)	12 (2.5%)	2 (0.4%)	12 (2.5%)
Drew curtains	292 (61.0%)	80 (16.7%)	10 (2.1%)	23 (4.8%)	26 (5.4%)	27 (5.6%)	21 (4.4%)
Heating controls	298 (62.2%)	67 (14.0%)	3 (0.6%)	18 (3.8%)	21 (4.4%)	50(10.4%)	22 (4.6%)
Lights off	333 (69.5%)	115 (24.0%)	7 (1.5%)	8 (1.7%)	1 (0.2%)	1 (0.2%)	44 (2.9%)
Electrical off	316 (66.0%)	72 (15.0%)	11 (2.3%)	22 (4.6%)	10 (2.1%)	24 (5.0%)	24 (5.0%)
Heating off	209 (43.6%)	78 (16.3%)	20 (4.2%)	64 (13.4%)	56 (11.7%)	36 (7.5%)	16 (3.3%)
Alyth: Before the SSE programme began							
Standby	160 (33.4%)	142 (29.6%)	24 (5.0%)	87 (18.2%)	43 (9.0%)	5 (1.0%)	18 (3.8%)
Kettle	144 (30.1%)	148 (30.9%)	31 (6.5%)	94 (19.6%)	41 (8.6%)	5 (1.0%)	16 (3.3%)
Drew curtains	278 (58.0%)	79 (16.5%)	18 (3.8%)	34 (7.1%)	29 (6.1%)	17 (3.5%)	24 (5.0%)
Heating controls	276 (57.6%)	74 (15.4%)	7 (1.5%)	32 (6.7%)	20 (4.2%)	41 (8.6%)	29 (6.1%)
Lights off	275 (57.4%)	134 (28.0%)	14 (2.9%)	32 (6.7%)	2 (0.4%)	5 (1.0%)	17 (3.5%)
Electrical off	269 (56.2%)	78 (16.3%)	13 (2.7%)	50 (10.4%)	19 (4.0%)	25 (5.2%)	25 (5.2%)
Heating off	184 (38.4%)	86 (18.0%)	17 (3.5%)	67 (14.0%)	78 (16.3%)	29 (6.1%)	47 (3.8%)

For each innovation in each community, there was a higher report of respondents adopting 'all the time' *after* the SSE intervention than before the intervention. In addition, in all but two cases, there were fewer reports of 'never' performing an energy efficient action *after* the intervention than before. However, after returns were received, the internal validity of this behavioural innovation has been questioned by the researcher. It appeared during data entry that there was high tendency for respondents to fill in the two sets of questions exactly the same, which is not uncommon with repeated questions (Schwarz & Oyserman 2001). Crosstabulations of each innovation, before intervention and after intervention, in each community seemed to indicate there may have been a slight tendency to do so for each question, though chi-square tests always revealed highly significant differences (though these always violated the rule that more than 20% of cells had fewer than 5 expected counts and are thus not reliable). If respondents did repeat their answers of one set in the other set, this may have been done to make answers appear consistent, or due to acquiescence (de Vaus 2002), or there may have been efforts to reflect a socially desirable behaviour (de Vaus 2002). In addition, it was not uncommon for respondents to not fill in the second set of questions asking about actions before the intervention began. There are several reasons this could have occurred: perhaps due to recall difficulties (see section 7.2.5.2 on recall), or due to the feeling of the respondent that entering information twice was redundant. Another issue revolved around the timing of the questionnaire, which was sent in the summer of 2009. This meant that respondents did not have the opportunity to, for example, draw the curtains at night if it was cold, several of which indicated this by writing in the margins.

As discussed in Chapter 7, reliability concerns the consistency and repeatability of items. "A *reliable* measure is one for which we can depend on obtaining *consistent* responses" (de Vaus 2002b, p.17). Tests for reliability vary by the type of measure. Single-item measures, which are those for which single questions are asked to obtain information on a concept, have little choice in the method of reliability testing; "the test-retest method is the only available method since all the other methods rely on multiple items" (de Vaus 2002, p.21). Most of the items in the questionnaire used in this research were single-item measures. There was no retest performed, so there is often little way to measure reliability within each community. However, where multiple items can feasibly be considered to pertain to the same concept, tests of reliability are applicable. In order to test the reliability of the two sets of behavioural questions, Cronbach's alpha (α) reliability tests were performed. Coefficients arising from Cronbach's α should generally by 0.8 or above (Bryman & Cramer 2001), though 0.7 is often considered adequate (de Vaus 2002). Question 23 a-g was the set of questions

to ask about behaviour in the home, which asked what respondents did in the last 7 days. Cronbach's α revealed fairly low reliability in North Leigh (α=0.64), higher reliability in St Athan (α=.78) and adequate reliability in Alyth (α=.67). Question 28 a-g was the second set of questions to ask about behaviour in the home, which asked what respondents did before the interventions began. Cronbach's α revealed sufficient reliability in North Leigh (α=0.77), higher reliability in St Athan (α=.82) and sufficient reliability in Alyth (α=.78). A split-half reliability test was then performed which ultimately compared the two scales, i.e. before and after. Cronbach's α revealed sufficient reliability in North Leigh (α=0.77), higher reliability in St Athan (α=.82) and sufficient reliability in Alyth (α=.78). These tests reveal that each scale had at least an adequate internal reliability, with the one exception of a rather low reliability in North Leigh regarding the scale asking about behaviour in the last 7 days.

To further understand the relationship between the two scales, bivariate correlations were performed. No overall correlation between the two whole scales was possible, but correlations were possible between each equivalent variable (i.e. 23a and 28a). Using the Spearman's rank test, results indicated that each variable in Q23 in each community was significantly and positively correlated with its equivalent in Q28. This would indicate similar patterns between behaviours *before* the interventions and after the intervention, meaning that behavioural actions had not greatly change in the timeframe of the SSE intervention.

However, though there do not appear to be great changes between the time before the interventions and the 'current' behaviour of the respondents, Appendix Table 27 indicates at least slight changes.

Innovation-decision process and adoption

The initial intention of the research was to ascertain the differences in the accessibility and mobilisation of social capital at each stage of the innovation-decision process, particularly in the WWDF, AHL and Visual categories as indicated in Appendix Table 26 and Appendix Table 27 above. However, all the tests for each hypothesis yielded insignificant data in most of the categories, which inhibited the validity of findings, particularly in tests using Pearson's chi-square which requires that 20% of cells have expected frequencies of 5 or more, which was always violated due to low frequency of responses in the middle categories of the innovation-decision process. The data were thus combined in several different ways and further tests conducted. A decision was made to exclude those who indicated adopting *before* the intervention occurred, as the mobilisation of 'energy social capital' was only measured in the time *after* the

intervention. One attempt to combine the variables resulted in three stages: implementation (those who adopted after the intervention); decision (those who had considered and were still deciding, were planning to get, or had ordered it and were waiting for installation), and rejection (those who had considered and decided against or did not consider, and in the case of Visual displays, had adopted but then discontinued using). The results are summarised for three innovation categories in Appendix Table 28.

Appendix Table 28: Innovation-decision categories collapsed into 3 categories

Community	Innov. category	Innovation	Implementation (adopted after intervention)	Decision (decided but have not yet adopted, or still considering)	Rejection
North Leigh		Cavity wall insulation	22 (31.0%)	14 (19.7%)	35 (49.3%)
		Solid wall insulation	5 (7.4%)	2 (2.9%)	61 (89.7%)
		Loft insulation	28 (46.7%)	22 (36.7%)	10 (16.7%)
		Floor insulation	8 (8.2%)	4 (4.1%)	85 (87.6%)
	WWDF	Door draughtproofing	14 (15.2%)	15 (16.3%)	63 (68.5%)
		Window draughtproofing	10 (13.2%)	8 (10.5%)	58 (76.3%)
		Heavy curtains	17 (17.9%)	22 (23.2%)	56 (58.9%)
		Double-glazing	20 (71.4%)	3 (10.7%)	5 (17.9%)
		Secondary-glazing	2 (4.4%)	-	43 (95.6%)
		Smart meter	49 (25.8%)	29 (15.3%)	112 (58.9%)
	Visual	Current cost monitor	85 (43.4%)	15 (7.7%)	96 (49.0%)
		Infrared thermal imaging	17 (10.2%)	6 (3.6%)	144 (86.2%)
		Heating system upgrade	24 (28.9%)	23 (27.7%)	36 (43.4%)
		Heating controls	28 (40.0%)	12 (17.1%)	30 (42.9%)
	AHL	Radiator reflectors	6 (4.3%)	13 (9.2%)	122 (86.5%)
		'A' rated appliances	48 (41.4%)	20 (17.2%)	48 (41.4%)
		Low-energy bulbs	116 (77.9%)	22 (14.8%)	11 (7.4%)
St Athan		Cavity wall insulation	27 (35.5%)	17 (22.4%)	32 (42.1%)
		Solid wall insulation	5 (8.2%)	3 (4.9%)	53 (86.9%)
		Loft insulation	19 (40.4%)	12 (25.5%)	16 (34.0%)
		Floor insulation	-	3 (4.5%)	63 (95.5%)
	WWDF	Door draughtproofing	7 (12.7%)	8 (14.5%)	40 (72.7%)
		Window draughtproofing	6 (10.9%)	12 (21.8%)	37 (67.3%)
		Heavy curtains	12 (18.2%)	8 (12.1%)	46 (69.7%)
		Double-glazing	11 (44.0%)	5 (20.0%)	9 (36.0%)
		Secondary-glazing	-	1 (3.0%)	32 (97.0%)
		Smart meter	41 (29.5%)	20 (14.4%)	78 (56.1%)
	Visual	Current cost monitor	30 (23.2%)	8 (6.2%)	91 (07.5%)
		Infrared thermal imaging	1 (0.8%)	6 (4.9%)	116 (94.3%)
		Heating system upgrade	27 (38.0%)	8 (11.3%)	36 (50.7%)
		Heating controls	21 (33.9%)	8 (12.9%)	33 (53.2%)
	AHL	Radiator reflectors	4 (3.8%)	6 (5.8%)	94 (90.4%)
		'A' rated appliances	30 (36.1%)	18 (21.7%)	35 (42.2%)
		Low-energy bulbs	61 (71.8%)	13 (15.3%)	11 (12.9%)
Alyth		Cavity wall insulation	7 (6.9%)	24 (23.8%)	70 (69.3%)
		Solid wall insulation	7 (5.7%)	14 (11.5%)	101 (82.8%)
		Loft insulation	50 (56.2%)	22 (24.7%)	17 (19.1%)
		Floor insulation	13 (7.2%)	12 (6.6%)	156 (86.2%)
	WWDF	Door draughtproofing	26 (17.0%)	40 (26.1%)	87 (56.9%)
		Window draughtproofing	23 (19.5%)	18 (15.3%)	77 (65.3%)
		Heavy curtains	38 (25.3%)	35 (23.3%)	77 (51.3%)
		Double-glazing	45 (60.0%)	9 (12.0%)	21 (28.0%)
		Secondary-glazing	1 (1.6%)	4 (6.5%)	57 (91.9%)
		Smart meter	82 (22.2%)	74 (20.1%)	213 (57.7%)
	Visual	Current cost monitor	63 (19.1%)	36 (7.5%)	231 (70.0%)
		Infrared thermal imaging	5 (1.6%)	16 (5.2%)	288 (93.2%)
		Heating system upgrade	69 (14.4%)	31 (19.6%)	58 (36.7%)
		Heating controls	51 (45.5%)	13 (11.6%)	48 (42.9%)
	AHL	Radiator reflectors	10 (4.2%)	35 (14.6%)	194 (81.2%)
		'A' rated appliances	94 (45.4%)	40 (19.3%)	73 (35.3%)
		Low-energy bulbs	191 (75.5%)	31 (12.3%)	31 (12.3%)

Although Appendix Table 28 presents data in a form which has been used in at least one other study (e.g. Ball et al. 1999) divided respondents into 'considered' an energy efficiency innovation and 'adopted' an energy efficiency innovation) and which may appear to yield at least some useful comparisons to other variables as there are fewer missing data (although many low frequencies), it was deemed too difficult to produce one scale for comparison to mobilised 'energy social capital'. Therefore, respondents were divided into those who had 'adopted after the intervention' and those who had 'not yet adopted' (which combined all those considering or who had rejected). A type of scale was formed by considering a respondent an adopter if he or she indicated adopting at least one (1) or more innovations per innovation category after the intervention. For example, if a respondent indicated that he or she installed cavity wall insulation after the date of intervention (e.g. September 2007 in North Leigh and Alyth), but did not indicate adopting any other innovation after September 2007, he or she was considered an adopter. If a respondent indicated that they had not adopted any innovation after September 2007 (but may have adopted before that time), they were in the category 'no (yet) adopted'.

Social capital

There were two forms of individual-level social capital which were measured: accessible energy social capital and mobilised energy social capital. Each is explained in greater detail below, according to each hypothesis which was tested, but the general findings are summarised here.

Accessible 'energy social capital'

Whilst resource generators have been created to address general social capital (van der Gaag 2005; Webber & Huxley 2007), a resource generator has not been created to measure a specific domain of resources. There is no precedent, and therefore no results with which to directly compare findings. Despite this fact, the applicability for finding accessible 'energy social capital' with an instrument which is relatively quick to administer and has been previously used in self-completion questionnaires (Webber & Huxley 2007) made it an attractive measurement instrument. However, the limitations of content and criterion validity must be acknowledged when analysing results.

Accessible 'energy social capital' was measured using a resource generator which was created to only address household energy conservation and efficiency measures. Question 7 in the questionnaire consisted of one primary question ('*Do you know anyone who* ...') and twelve sub-questions. The frequency of responses to these

questions are summarised in Appendix Table 29, Appendix Table 30, and Appendix Table 31.

Appendix Table 29: Responses to Energy Efficiency Resource Generator (Q7), North Leigh

North Leigh (N=227)				*If yes, % access through:*						
		n	% 'Yes'	Imm. Family	Wider family	Friend	Neigh.	In N Leigh	Coll.	Acquaint
Ques #	*Do you know anyone who ...*									
7a	...would give you sound advice on energy efficiency?	221	**59.3**	36.6	8.4	27.5	14.5	37.4	11.5	9.9
7b	...would help you find information on energy efficiency?	220	**68.2**	38.0	6.7	20.7	14.7	31.3	12.0	9.3
7c	...would give you sound advice on changing day-to-day activities to help reduce energy use in your home?	218	**55.5**	35.5	7.4	22.3	10.7	35.5	10.7	12.4
7d	...would give you sound advice on how to use your heating system more efficiently?	218	**56.9**	29.0	12.9	22.6	8.9	26.6	8.1	19.4
7e	...would give you sound advice on real-time energy displays (i.e. Smart meters or current cost monitors?)	216	**47.2**	22.5	8.8	15.7	13.7	42.2	5.9	13.7
7f	...is an electrician or works directly with electrical equipment?	220	**63.2**	18.0	10.8	30.2	5.8	7.2	7.9	30.9
7g	...would give you sound advice on purchasing energy efficiency windows?	214	**48.6**	26.9	9.6	29.8	4.8	11.5	6.7	26.9
7h	...would give you sound advice on insulating your house?	217	**50.7**	30.9	10.0	22.7	10.0	23.6	8.2	13.6
7i	...can explain the pros and cons of having a smart meter installed?	216	**38.0**	18.3	6.1	22.0	9.8	43.9	7.3	14.6
7j	...would give you sound advice on purchasing energy efficient heating systems?	217	**47.9**	27.9	7.7	28.8	5.8	22.1	5.8	22.1
7k	...would give you sound advice on purchasing energy efficient appliances for your kitchen?	219	**45.7**	39.0	12.0	19.0	6.0	24.0	8.0	16.0
7l	...knows a lot about DIY?	216	**75.5**	62.8	14.0	29.3	11.6	9.8	6.1	11.0

Appendix Table 30: Responses to Energy Efficiency Resource Generator (Q7), St Athan

St Athan (N=187)		*n*	% 'Yes'	*If yes, % access through:*						
				Imm. Family	Wider family	Friend	Neigh.	In St Athan	Coll.	Acquaint
Ques #	*Do you know anyone who ...*									
7a	...would give you sound advice on energy efficiency?	170	**41.2**	52.9	15.7	28.6	17.1	15.7	15.7	14.3
7b	...would help you find information on energy efficiency?	168	**60.7**	45.1	16.7	38.2	10.8	9.8	15.7	12.7
7c	...would give you sound advice on changing day-to-day activities to help reduce energy use in your home?	169	**42.0**	45.1	11.3	36.6	12.7	8.5	12.7	15.5
7d	...would give you sound advice on how to use your heating system more efficiently?	168	**47.6**	35.0	15.0	31.3	6.3	10.0	13.8	20.0
7e	...would give you sound advice on real-time energy displays (i.e. Smart meters or current cost monitors?)	167	**31.7**	34.0	7.5	22.6	5.7	13.2	1.9	18.9
7f	...is an electrician or works directly with electrical equipment?	167	**64.1**	30.8	9.3	29.0	13.1	8.4	9.3	9.3
7g	...would give you sound advice on purchasing energy efficiency windows?	166	**40.4**	38.8	9.0	26.9	7.5	6.0	7.5	19.4
7h	...would give you sound advice on insulating your house?	166	**41.0**	35.3	5.9	30.9	13.2	5.9	11.8	13.2
7i	...can explain the pros and cons of having a smart meter installed?	166	**29.5**	36.7	2.0	34.7	2.0	10.2	4.1	14.3
7j	...would give you sound advice on purchasing energy efficient heating systems?	166	**37.3**	41.9	3.2	30.6	6.5	9.7	6.5	11.3
7k	...would give you sound advice on purchasing energy efficient appliances for your kitchen?	166	**36.7**	44.3	9.8	26.2	6.6	8.2	11.5	13.1
7l	...knows a lot about DIY?	169	**71.6**	62.8	8.3	33.1	9.1	5.8	10.7	6.6

Appendix Table 31: Responses to Energy Efficiency Resource Generator (Q7), Alyth

Alyth (N=479)		*n*	% 'Yes'	*If yes, % access through:*						
				Imm. Family	Wider family	Friend	Neigh.	In Alyth	Coll.	Acquaint
Ques #	*Do you know anyone who ...*									
7a	...would give you sound advice on energy efficiency?	456	**58.3**	31.3	7.9	23.0	8.3	38.1	7.9	14.0
7b	...would help you find information on energy efficiency?	449	**73.1**	31.7	9.5	25.0	8.8	34.1	8.5	9.1
7c	...would give you sound advice on changing day-to-day activities to help reduce energy use in your home?	445	**61.3**	30.0	9.9	21.6	7.3	35.9	8.4	9.2
7d	...would give you sound advice on how to use your heating system more efficiently?	449	**66.1**	30.3	6.4	22.9	6.4	29.6	5.4	15.5
7e	...would give you sound advice on real-time energy displays (i.e. Smart meters or current cost monitors?)	445	**46.3**	22.8	6.3	20.4	6.3	36.4	6.8	12.1
7f	...is an electrician or works directly with electrical equipment?	449	**67.3**	15.9	5.6	30.5	5.6	20.5	6.6	24.5
7g	...would give you sound advice on purchasing energy efficiency windows?	447	**47.4**	25.0	8.0	22.6	5.2	21.7	6.1	20.3
7h	...would give you sound advice on insulating your house?	444	**54.7**	30.9	7.4	22.6	7.0	25.5	9.5	14.4
7i	...can explain the pros and cons of having a smart meter installed?	444	**42.1**	17.6	5.9	19.3	5.9	36.9	8.6	16.6
7j	...would give you sound advice on purchasing energy efficient heating systems?	448	**55.6**	22.9	7.2	22.5	5.6	26.1	5.2	22.9
7k	...would give you sound advice on purchasing energy efficient appliances for your kitchen?	447	**48.5**	33.6	10.6	22.1	5.1	26.7	6.0	14.3
7l	...knows a lot about DIY?	452	**74.6**	55.5	13.4	28.5	9.2	11.9	6.5	8.9

Appendix Table 29, Appendix Table 30 and Appendix Table 31 summarise the findings the responses to the Energy Efficiency Resource Generator. In each village, the most popular item was 'knows a lot about DIY', which is the one item which was taken from the RG-UK (Webber & Huxley 2007). In North Leigh, 75.5% knew someone who knew a lot about DIY; in St Athan, 71.6% knew someone and in Alyth, it was 74.6%. Webber and Huxley (2007), by comparison, found that 83.1% knew someone who 'knows a lot about DIY' (p.488). The least popular item was also consistent across communities: less people knew anyone who 'can explain the pros and cons of having a smart meter installed' than any other item (38% in North Leigh; 29.5% in St Athan; and 42.1% in Alyth).

Appendix Table 32 summarises responses of the general findings of the energy efficiency resource generator, and compares it to findings from two other resource generators. The two comparison generators were measuring 'general' social capital –

Webber and Huxley (2007) in the United Kingdom and van der Gaag & Snijders (2005) in the Netherlands – but are provided here merely as a very general benchmark.

Appendix Table 32: Energy Efficiency Resource Generator findings compared to two other Resource Generators

Community or comparison study	Average missing items per respondent	Average number of items to which respondents had access	Total average (%) of respondents who indicate knowing anyone with a resource
North Leigh	0.49 (95%CI=0.24-0.75)	6.23 (95%CI=5. 17,6.75) of 12 items	54.7%
St Athan	1.20 (95%CI=0.72-1.69)	4.90 (95%CI=4.33,5.46) of 12 items	45.3%
Alyth	0.78 (95%CI=0.54-1.02)	6.51 (95%CI=6.14,6.87) of 12 items	57.9%
Webber & Huxley 2007 (RG-UK)	0.6	17.24 (95%CI=16.54,17.93) of 27 items	Unknown
Van der Gaag & Snijders 2005 (SSND)	0.9	unknown	76%

Appendix Table 32 indicates that the average number of missing items per respondent was quite varied across villages. The average number of missing items per respondent was: 0.49 in North Leigh, 1.20 in St Athan and 0.78 in Alyth. In the comparison surveys, there were 0.9 missing items per respondent in the Netherlands 'general' social capital study (van der Gaag & Snijders 2005) and 0.6 in the UK 'general' social capital study (Webber & Huxley 2007). Thus, North Leigh had less missing items than any other village or survey, though both St Athan and Alyth had more missing items than the UK resource generator. The findings also indicate that the average number of items to which respondents had access was slightly less than in the RG-UK (Webber & Huxley 2007). In North Leigh and Alyth, respondents indicated having access to just over half of the items, whereas respondents in St Athan indicated having access to less than half of the items (about 41%). Averaged across the twelve items (i.e. the average of the '% Yes'), 54.7% of North Leigh respondents indicated knowing anyone with access to a resource; 45.3% in St Athan indicated knowing anyone with access to a resource item; and 57.9% in Alyth. This was much lower than the 76% found in the general social capital resource generator in the Netherlands. Though the energy efficiency resource generator yielded more missing items per respondent in St Athan (as compared to RG-UK and SSND) and Alyth (as compared to RG-UK), lower average number of items accessed and lower percentage of respondents who knew anyone with a resource, the resources of energy efficiency information are much more specific than the 'general' items which Webber & Huxley (2007) or van der Gaag & Snijders (2005) were measuring. Therefore, it is not completely unexpected that the comparisons work out this way. A notable exception was the low number of average missing item frequencies per respondent in North Leigh.

Generally, in order to find latent traits from multiple questions, a form of exploratory factor analysis would be performed, as factor analysis techniques are designed to identify "underlying hypothetical constructs to account for the relationship between variables" (Foster et al. 2006, p.70). However, factor analysis generally requires data to be at the normally distributed at the interval level (Foster et al. 2006). What is more common for resource generator evaluation is the use of exploratory non-parametric item response theory, which can handle ordinal and dichotomous data (van der Gaag & Snijders 2005; Webber & Huxley 2007). A unidirectional cumulative scale is one which evaluates data in terms of 'more' or 'less,'[226] which makes it appropriate for social capital, which is generally evaluated in similar terms (van der Gaag & Snijders 2005, p.7). The method of 'Mokken scaling' (or cumulative scaling) is a "non-parametric item response theory method that aims to find robust and one-dimensional scales within sets of items" (van der Gaag & Webber 2008, p.42). A cumulative scale model assumes "that the represented latent trait has a cumulative character" (van der Gaag 2005, p.70). For example, if a person answers 10 questions and scores a '4' then it should indicate that the person scored highly, or affirmatively, on the first four items of the total 10 (Trochim 2006). This also means that the model assumes that those who can access resources which are less 'easy' or available to access are also able to access those resources which are the most popular. Using an example from Appendix Table 29, Appendix Table 30, and Appendix Table 31, it appears that knowing someone who can explain the pros and cons of a smart meter is the least popular, or least available resource item. In order to ascertain this, the model used here does exploratory analysis to understand if perhaps there are multiple scales, each with related cumulative effects.

The analysis was performed using a software designed for this cumulative scaling of non-parametric dichotomous data, MSP 5 for Windows[227] (Molenaar & Sijtsma 2000). The scaling procedure in MSP 5 is based on Loevinger's *H*-coefficients (Loevinger 1947) "to express the fit of specific items within a scale and for the homogeneity of the scale as a whole" (van der Gaag & Webber 2008, p.42). If items are uncorrelated, $H=0$ or can even be negative (revealing inhomgeneity). If scores are perfectly correlated, $H=1$. Conventionally, if $H \geq 0.3$, a scale is considered 'useful', if $H \geq 0.4$, a scale is considered 'medium strong'; and if $H \geq 0.5$, the scale is considered 'strong' (van der Gaag & Webber 2008, p.42; Webber & Huxley 2007, p.484). Loevinger's homogeneity

[226] In contrast, unfolding item response theory looks at polar opposites, such as items which would be at either end of a spectrum (i.e. left wing or right wing political spectrum).
[227] MSP stands for Mokken Scaling of Polytomous items, though it also can handle dichotomous items (Molenaar and Sijtsma 2000).

can be calculated for each item (H_i) and for a whole scale (H). Alongside each whole scale a reliability coefficient, rho (ρ), is also calculated. Rho values greater than 0.6 generally are indicative of sufficient reliability (Molenaar & Sijtsma 2000).

MSP 5 uses an exploratory search technique whereby it first identifies the pair of scores with the highest homogeneity and calculates an *H* value. It then proceeds by adding the next best fitting item and calculating another *H* value, and so on until it reaches a threshold. This threshold is set to 0.30 by default in MSP 5. If the *H* value falls below that level, that next score is not included. It will then start again and form a new scale. Thus, several scales often emerge, as they did in the research conducted by van der Gaag & Snijders (2005) and Webber & Huxley (2007), each of which ultimately formed four subscales.

Using the MSP 5 software for each of the three villages, it ended up that only one scale emerged which, in the case of North Leigh and St Athan, included all items. In Alyth, one item was excluded. The *H*-coefficients for each scale were 'strong' as they were greater than 0.50. The reliability for each was also quite high, as ρ was well above 0.60. Data were deleted listwise, so the total N were reduced from the original numbers, and are stated in Appendix Table 33.

Appendix Table 33: 'Mokken scaling' results from MSP 5 for Energy Efficiency Resource Generator

		North Leigh N = 204 H = 0.52 ρ = 0.90	**St Athan** N = 156 H = 0.54 ρ = 0.90	**Alyth** N = 424 H = 0.60 ρ = 0.92
Ques #	*Do you know anyone who ...*	H_i	H_i	H_i
7a	...would give you sound advice on energy efficiency?	0.56	0.52	0.62
7b	...would help you find information on energy efficiency?	0.56	0.54	0.68
7c	...would give you sound advice on changing day-to-day activities to help reduce energy use in your home?	0.57	0.53	0.60
7d	...would give you sound advice on how to use your heating system more efficiently?	0.60	0.55	0.62
7e	...would give you sound advice on real-time energy displays (i.e. Smart meters or current cost monitors?)	0.55	0.61	0.59
7f	...is an electrician or works directly with electrical equipment?	0.31	0.32	Not included
7g	...would give you sound advice on purchasing energy efficiency windows?	0.37	0.53	0.57
7h	...would give you sound advice on insulating your house?	0.54	0.58	0.59
7i	...can explain the pros and cons of having a smart meter installed?	0.62	0.60	0.64
7j	...would give you sound advice on purchasing energy efficient heating systems?	0.49	0.57	0.60
7k	...would give you sound advice on purchasing energy efficient appliances for your kitchen?	0.60	0.56	0.62
7l	...knows a lot about DIY?	0.51	0.51	0.41

The results here indicate that there was a high homogeneity of responses across all 12 items in North Leigh and St Athan and across 11 items in Alyth, i.e. all *H* scores were greater than 0.5, with very high reliability (i.e. ρ = 0.90 or above). Interestingly, the excluded question, 'Do you know anyone who ... is an electrician or works directly with electrical equipment' received the lowest H_i scores in North Leigh and St Athan, as well. The results suggest that the questions are highly related, which is not surprising, considering they were all addressing a very specific topic of household energy efficiency. However, it does provide justification for using the scale, and adds validity to the use of the Energy Efficiency Resource Generator.

Mobilised 'energy social capital'

Mobilised 'energy social capital' was measured by asking if respondents had spoken anyone for advice about the innovations. If the respondents answered affirmatively, they were asked to list up to three people with whom they spoke about any innovation within a given category. As there were four categories, there was a potential to speak with up to twelve people. However, as Appendix Table 34 indicates, no one spoke to

more than 6 people in North Leigh and St Athan, and no one spoke to more than 9 people in Alyth.[228]

Appendix Table 34: Number (percent) of respondents who indicated speaking to a given number of alters

Number	North Leigh (N=227)	St Athan (N=187)	Alyth (N=479)
None (0)	103 (45.4%)	109 (58.6%)	252 (52.6%)
One (1)	49 (21.6%)	25 (13.4%)	74 (15.4%)
Two (2)	28 (12.3%)	20 (10.8%)	50 (10.4%)
Three (3)	33 (14.5%)	22 (11.8%)	74 (15.4%)
Four (4)	7 (3.1%)	6 (3.2%)	10 (2.1%)
Five (5)	4 (1.8%)	3 (1.6%)	8 (1.7%)
Six (6)	3 (1.3%)	1 (0.5%)	8 (1.7%)
Seven (7)	-	-	-
Eight (8)	-	-	1 (0.2%)
Nine (9)	-	-	2 (0.4%)

The numbers in Appendix Table 34 are based solely on self-reports by respondents, and do not include those who indicated that 'yes' they spoke to someone, but then did not fill in any names or initials, which was not an uncommon occurrence. Therefore, it is expected that these numbers under-represent the number of people with whom the respondents may have actually spoken.

In summary, about 54% of respondents indicated speaking to at least one person in North Leigh. In St Athan, about 41% of respondents indicated speaking to at least one person. And in Alyth, approximately 47% of respondents indicated speaking to at least one person.

There were two 'awareness' questions asked which would be useful to compare with the findings of mobilised social capital. The first is Q3: *Would you say you are aware of the [name of project] project which has been running since [date]?* As the message was often spread through word of mouth, as described in section 8.2, it would be useful to examine any correlations with the number of people with whom the respondent spoke. Also, Q4: *Have you discussed or talked about anything concerning the [name of project] project with anyone?* may also yield information about whether there in the number of people spoken to between those who did, or did not, indicate discussing the project. As the number of people with whom respondents spoke was not a normally-distributed variable (confirmed with Kolmogorv-Smirnov tests, all resulted in $p<.05$ which indicates non-normality), simple logistic regression tests were performed, which

[228] As names could be repeated for each innovation category, this tally had to be added up by hand, and was based on the researchers interpretation of whether she thought there was a repetition of named alters based on initials written by each respondent. This means that there is room for error, both in the counting process and in the interpretation of respondents' handwriting.

is a test appropriate when the outcome (dependent) variable is categorical and the independent variable is interval and non-normal.

As explained in Chapter 8, the beta coefficient (exp *b*) is the odds ratio, which is important for interpreting the results. The Wald statistic is crucial, indicating "whether the *b*-coefficient for [the] predictor is significantly different from zero" (Field, p.239). The goodness-of-fit tests indicate "how well a model fits the data from which it was generated" (Field 2005, p.732); the -2*log-likelihood (-2LL) is a deviance measure, there are two pseudo-R square tests (Cox & Snell and Nagelkerke).

The variable which summed the number of people with whom the respondent had spoken in total is the independent variable, which was tested against the dependent variable of programme awareness (Aware Q3) and then against the dependent variable which asked whether the respondent had discussed the programme with anyone (Discussed Q4). The results are summarised in Appendix Table 35; the most important numbers to note are the Wald statistic and its significance and the exp *b*.

Appendix Table 35: Logistic regression results of total number of people the respondent spoke with and two variables: programme awareness (Q3) and indication of speaking to anyone about the programme (Q4)

		North Leigh		St Athan		Alyth	
		Aware (Q3)	Discussed (Q3)	Aware (Q3)	Discussed (Q3)	Aware (Q3)	Discussed (Q3)
Model	Constant B (SE)	2.235 (.327)	-.265 (.191)	.423 (.199)	-.923 (.256)	2.345 (.208)	-.510 (.127)
	Wald	3.813	16.284***	1.638	9.783**	.226	35.920***
	exp *b*	2.076	1.626	1.171	1.551	1.055	1.597
	exp *b* 95% CI	.997,4.322	1.284,2.060	.920,1.491	1.178,2.041	.845,1.317	1.371,1.862
	Model χ^2	6.103*	19.619***	1.714	10.836**	.235	44.520***
Good-ness-of-fit	-2LL	92.537	260.456	212.561	147.831	261.880	551.587
	Cox & Snell R^2	0.027	.091	.010	.088	.001	.098
	Nagelkerke R^2	0.076	.123	.014	.119	.001	.131

*p<.05, **p<.01, ***p<.001

Appendix Table 35 indicates that there were no significant results arising from the Q3 (i.e. North Leigh: exp *b* =2.076, Wald = 0.813, *not significant (ns)*; St Athan: exp *b* = 1.171, Wald = 1.638, *ns*; Alyth: exp *b* = 1.055, Wald = .266, *ns*). This indicates that speaking with more people had no statistical effect on the programme awareness. However, each community had a significant result with Q4. The data is interpreted as such: in North Leigh, for each additional person the respondent indicated speaking to, the odds of the respondent indicating they had discussed the programme (Q4) are 1.63 times greater. In St Athan, for each additional person the respondent speaks to the

odds of the respondent indicating they had discussed the programme (Q4) are 1.55 times greater. And in Alyth, for each additional person the respondents speaks to, the odds of the respondent indicating they had discussed the programme (Q4) are 1.6 times greater. The relatively low pseudo R^2 scores (Cox & Snell and Nagelkerke), however, means that the results do not appear to account for a high degree of variability in the model.

If there is no relation between awareness and the number of people with whom respondents sought energy-related information, it may be that awareness is more related to messages from the media or organisations than from people. Qualitative findings yielded a few comments about information needing to be 'drip fed', which seems to refer to both media sources and personal communication.

> R18 (NL): "When I think that sort of communication is good. I mean had it not been for the drip feed that you get, you know you ignore perhaps every other month. But occasionally something catches your eye. A simple thing like a banner in the village about this event that's been going on today. I didn't come to it but it brings, it keeps the momentum going somehow. It just makes you think about it." (North Leigh, Resident Focus group 3)

> R1(AL): "I mean it's sort of a private theory, but there's an approach that trying to change people's attitudes over night in small communities in Scotland it just doesn't necessarily work, you can often get a reaction strongly back the other way. But a dripping tap will fill the sink in the end." (Alyth, Resident Focus group)

Based on these two comments, it seems that both media and personal communication are influential throughout the innovation-decision process, but it is difficult to say which is *more* important. Darley & Beniger (1981) and Ball et al. (1999) indicate that mass media influence is usually more influential for raising awareness, i.e. influencing the beginning stages of the innovation-decision process, but personal communication is more influential for adoption of energy efficiency measures, i.e. the latter stages of the innovation-decision process. Further research would be needed to test the media awareness association in this research.

Appendix K. BACKGROUND DATA FOR HYPOTHESES

This Appendix presents data for a selection of the Hypotheses discussed in Chapter 8.

Hypothesis 1

In order to understand what factors may have an association with the answer categories for Question 5, a number of crosstabulations were performed against other variables from the questionnaire which yield Pearson's chi-square test of significance results, as in Appendix Table 36.

Appendix Table 36: Results of chi-square tests of where to *find information first* (Q5) with other variables

	North Leigh			St Athan			Alyth		
	χ^2	***df***	**Sig**	**χ^2**	***df***	**Sig**	**χ^2**	***df***	**Sig**
Energy knowledge (Q6)	8.043[a]	4	0.09	8.836[b]	2	0.012*	44.644[c]	6	0.000***
How long lived in village (Q1)[d]	15.342	6	0.018*	14.138	6	0.028*	6.423	6	0.378
Education (Q46)	17.969	4	0.001**	13.177	4	0.010**	33.898	4	0.000***
Male / Female (Q48)	2.705	2	0.259	0.761	2	0.684	7.802	2	0.020*
Age of respondent (Q45)[e]	24.297	4	.000***	21.637	4	.000***	54.892	4	0.000***
Know anyone to give sound advice? (Q7a)	8.373	2	0.015*	0.503	2	0.777	3.36	2	0.191

*p<.05, **p<.01, ***p<.001

[a] Only compares 'a lot', 'a fair amount' and 'just a little' answer categories, as counts were too low in other categories to create a valid model

[b] Only compares 'a fair amount' and 'just a little' answer categories, as counts were too low in other categories to create a valid model

[c] No one answered 'Nothing - have never heard of it'

[d] Recoded to collapse lower ranges into '5 years or less'

[e] Recoded into three categories: 16-44, 45-64, 65+

There were significant associations in all three communities between Q5 and education (Q46) and age of respondent (Q45), which are examined in Chapter 8. In North Leigh, there was also a significant association of Question 5 with length of time the respondent lived in the village (χ^2 (6) = 15.34, p< .05), and whether the respondent knew anyone to give them sound advice (χ^2 (2) = 8.37, p< .05). In St Athan, there was a significant association between Question 5 and self-reported knowledge of energy efficiency (χ^2 (2) = 8.84, p< .05) and the length of time the respondent lived in the village (χ^2 (6) = 14.14, p< .05). In Alyth, there was a highly significant association of Question 5 with self-reported knowledge of energy efficiency (χ^2 (6) = 44.64, p< .001), and also an association between Q5 and the gender of the respondent (χ^2 (1) = 7.80,

p< .05). Two graphical representations were presented in Chapter 8, the frequencies for which are presented in Appendix Table 37 and Appendix Table 38.

Appendix Table 37: Frequencies of cross-tabulation between education level and Q5

Community	Education category	Q5 answer categories		
		Ask someone I know	Check media sources	Approach an org or group
North Leigh	Degree +	15	37	31
	Another qualification	40	23	26
	No qualifications	10	12	19
St Athan	Degree +	4	10	4
	Another qualification	26	33	27
	No qualifications	32	12	17
Alyth	Degree +	35	47	33
	Another qualification	54	56	69
	No qualifications	67	16	64

Appendix Table 38: Frequencies of cross-tabulation between age category (re-coded) and Q5

Community	Age category	Q5 answer categories		
		Ask someone I know	Check media sources	Approach an org or group
North Leigh	16 to 44 years	15	21	9
	45 to 64 years	34	42	29
	65+	18	11	39
St Athan	16 to 44 years	10	21	3
	45 to 64 years	26	25	24
	65+	27	10	23
Alyth	16 to 44 years	29	43	15
	45 to 64 years	56	59	64
	65+	72	20	92

Hypothesis 2

Appendix Table 39 represents the frequencies and binomial tests of significance for Hypothesis 2. The N represents the frequency. The observed proportion is the percent that indicated accessing 'energy social capital' from either someone in the community ('yes') or not in the community ('no'). This observed proportion was compared to a .50 (50%) benchmark; the Sig. (significance) indicates if the observed proportion was significantly different from .50.

Appendix Table 39: Binomial test results between Energy Efficiency Resource Generator questions and location of the resources (i.e. in community?)

		North Leigh			St Athan			Alyth		
Variable	**In Comm-unity?**	**N**	**Observed proportion**	**Sig.**	**N**	**Observed proportion**	**Sig.**	**N**	**Observed proportion**	**Sig.**
Q7a	No	67	.51	.861	49	.70	.001**	150	.56	.043*
	Yes	64	.49		21	.30		116	.44	
Q7b	No	84	.56	.165	81	.79	.000***	192	.59	.002**
	Yes	66	.44		21	.21		136	.41	
Q7c	No	67	.55	.275	56	.79	.000***	158	.58	.011*
	Yes	54	.45		15	.21		115	.42	
Q7d	No	81	.65	.001**	12	.15	.000***	105	.35	.000***
	Yes	43	.35		68	.85		192	.65	
Q7e	No	46	.45	.373	44	.83	.000***	119	.58	.031*
	Yes	56	.55		9	.17		87	.42	
Q7f	No	120	.89	.000***	86	.82	.000***	232	.78	.000***
	Yes	15	.11		19	.18		66	.22	
Q7g	No	87	.84	.000***	58	.87	.000***	156	.74	.000***
	Yes	17	.16		9	.13		56	.26	
Q7h	No	73	.66	.001**	55	.81	.000***	166	.68	.000***
	Yes	37	.34		13	.19		77	.32	
Q7i	No	38	.46	.581	43	.88	.000***	78	.42	.028*
	Yes	44	.54		6	.12		109	.58	
Q7j	No	75	.72	.000***	53	.85	.000***	172	.69	.000***
	Yes	29	.28		9	.15		77	.31	
Q7k	No	71	.71	.000***	52	.85	.000***	150	.69	.000***
	Yes	29	.29		9	.15		67	.31	
Q7k	No	132	.80	.000***	104	.86	.000***	275	.82	.000***
	Yes	32	.20		17	.14		62	.18	

*p<.05, **p<.01, ***p<.001,

Hypothesis 3

Appendix Table 40 represents the frequencies and binomial tests of significance for Hypothesis 3. The N represents the frequency. The observed proportion is the percent that indicated accessing 'energy social capital' from either a 'strong' or 'weak' tie. This observed proportion was compared to a .50 (50%) benchmark; the Sig. (significance) indicates if the observed proportion was significantly different from .50.

Appendix Table 40: Binomial test results between Energy Efficiency Resource Generator questions and whether the resources were access from strong or weak ties

		North Leigh			St Athan			Alyth		
Variable	**Category**	**N**	**Observed proportion**	**Sig.**	**N**	**Observed proportion**	**Sig.**	**N**	**Observed proportion**	**Sig.**
Q7a	Strong	48	.37	.004*	38	.56	.396	101	.39	.001**
	Weak	82	.63		30	.44		155	.61	
Q7b	Strong	58	.39	.013*	60	.59	.073	177	.55	.057
	Weak	89	.61		41	.41		142	.45	
Q7c	Strong	43	.37	.005**	28	.41	.148	149	.57	.026*
	Weak	74	.63		41	.59		112	.43	
Q7d	Strong	71	.58	.104	33	.43	.302	157	.55	.110
	Weak	52	.42		43	.57		129	.45	
Q7e	Strong	71	.71	.000***	30	.61	.152	78	.39	.003*
	Weak	29	.29		19	.39		120	.61	
Q7f	Strong	69	.52	.729	63	.61	.039*	130	.44	.061
	Weak	64	.48		41	.39		163	.56	
Q7g	Strong	50	.50	1.000	25	.38	.082	97	.47	.397
	Weak	51	.50		40	.62		107	.53	
Q7h	Strong	48	.45	.382	36	.58	.253	108	.46	.295
	Weak	58	.55		26	.42		125	.54	
Q7i	Strong	59	.72	.000***	31	.67	.026	118	.66	.000***
	Weak	23	.28		15	.33		60	.34	
Q7j	Strong	54	.52	.694	39	.68	.008**	95	.40	.003**
	Weak	49	.48		18	.32		141	.60	
Q7k	Strong	48	.49	.920	38	.64	.036*	103	.50	1.000
	Weak	50	.51		21	.36		102	.50	
Q7k	Strong	111	.69	.000***	90	.77	.000***	99	.30	.000***
	Weak	51	.31		27	.23		231	.70	

*p<.05, **p<.01, ***p<.001

Hypothesis 5

Appendix Table 41, Appendix Table 42 and

Appendix Table 43 contains the frequencies for adoption and non-adoption within each innovation category, according to whether or not the respondent indicated discussing the innovations with anyone, by age, education and ownership of home. This data was used to determine Fisher's exact test in Chapter 8.

Appendix Table 41: Frequency of adopters of innovations (by innovation category) who did and did not discuss the innovations, by age category (frequencies)

			Age category					
			16-44 years		45-64 years		65+	
Comm-unity	Innov-ation	Adoption status	Yes, discussed	No, did not discuss	Yes, discussed	No, did not discuss	Yes, discussed	No, did not discuss
North Leigh	WWDF	Adopted	4	13	10	16	7	12
		Not adopted	2	20	12	42	2	18
	Visual	Adopted	6	11	21	33	13	22
		Not adopted	5	21	9	39	4	25
	AHL	Adopted	6	24	14	54	17	21
		Not adopted	2	9	2	22	3	15
	Behave	Adopted	0	10	1	25	3	28
		Not adopted	4	29	7	70	3	33
St Athan	WWDF	Adopted	1	9	3	17	2	10
		Not adopted	0	18	4	34	1	16
	Visual	Adopted	2	7	11	7	4	16
		Not adopted	2	21	6	37	4	25
	AHL	Adopted	3	17	8	25	3	21
		Not adopted	1	11	3	28	5	19
	Behave	Adopted	1	18	5	32	5	30
		Not adopted	2	14	5	34	4	24
Alyth	WWDF	Adopted	13	15	11	26	11	28
		Not adopted	4	34	10	80	4	48
	Visual	Adopted	7	10	12	23	12	41
		Not adopted	10	53	12	109	21	73
	AHL	Adopted	13	48	24	77	18	61
		Not adopted	1	16	9	44	5	34
	Behave	Adopted	1	32	7	74	11	97
		Not adopted	12	39	13	85	8	55

Appendix Table 42: Frequency of adopters of innovations (by innovation category) who did and did not discuss the innovation, by education category (frequencies)

			Education category					
			Degree +		Another qual		No quals	
Comm-unity	Innov-ation	Adoption status	Yes, discussed	No, did not discuss	Yes, discussed	No, did not discuss	Yes, discussed	No, did not discuss
North Leigh	WWDF	Adopted	14	17	4	16	2	7
		Not adopted	8	29	6	38	2	10
	Visual	Adopted	21	22	12	27	7	16
		Not adopted	9	30	7	41	2	14
	AHL	Adopted	3	16	12	41	6	16
		Not adopted	19	41	3	23	1	7
	Behave	Adopted	7	52	3	56	4	23
		Not adopted	1	22	2	27	1	12
St Athan	WWDF	Adopted	0	10	3	21	3	9
		Not adopted	0	6	2	37	3	21
	Visual	Adopted	3	4	16	59	5	14
		Not adopted	1	9	8	12	3	26
	AHL	Adopted	2	7	6	34	6	22
		Not adopted	2	9	4	31	3	18
	Behave	Adopted	1	6	4	42	6	23
		Not adopted	0	12	5	39	5	27
Alyth	WWDF	Adopted	15	15	12	31	7	23
		Not adopted	10	41	5	81	3	40
	Visual	Adopted	10	12	9	38	11	23
		Not adopted	13	73	12	103	16	55
	AHL	Adopted	22	40	24	86	7	58
		Not adopted	2	36	8	33	5	23
	Behave	Adopted	6	55	20	71	6	51
		Not adopted	3	45	9	77	6	76

Appendix Table 43: Frequency of adopters of innovations (by innovation category) who did and did not discuss the innovation, by ownership of home category (frequencies)

			Ownership			
			Own		Rent	
Community	**Innovation**	**Adoption status**	Yes, discussed	No, did not discuss	Yes, discussed	No, did not discuss
North Leigh	WWDF	Adopted	21	38	0	2
		Not adopted	14	73	2	4
	Visual	Adopted	34	61	5	4
		Not adopted	18	74	0	8
	AHL	Adopted	35	88	1	10
		Not adopted	7	43	0	2
	Behave	Adopted	13	121	0	10
		Not adopted	4	52	0	7
St Athan	WWDF	Adopted	6	24	0	10
		Not adopted	2	55	3	10
	Visual	Adopted	15	23	1	7
		Not adopted	10	66	2	14
	AHL	Adopted	12	46	0	17
		Not adopted	9	47	0	9
	Behave	Adopted	9	54	1	14
		Not adopted	8	55	3	24
Alyth	WWDF	Adopted	31	52	2	16
		Not adopted	16	135	0	17
	Visual	Adopted	23	54	6	17
		Not adopted	34	189	7	36
	AHL	Adopted	51	137	2	41
		Not adopted	11	81	1	9
	Behave	Adopted	27	140	5	34
		Not adopted	16	144	3	45

Hypothesis 5a

Examining the raw frequency data of only those who adopted, as seen in the shaded numbers (i.e. adopted category) in Appendix Table 44, one observation is that in Alyth, respondents always indicated that they spoke with more people who also lived in Alyth than who *did not* live in Alyth. The frequencies in North Leigh and St Athan did not yield the same sort of trend; the frequencies tended to vary by innovation and by whether it was the first, second or third alter (i.e. person) from whom the respondent sought information.

Appendix Table 44: Adopters of innovations & the location (i.e. in the same community?) of the alters with whom the respondent spoke to about those innovations (frequencies)

Community & Alter	WWDF		Visual		AHL		Behave	
	In community?		**In community?**		**In community?**		**In community?**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
North Leigh, Alter 1								
Adopted	6	12	18	7	15	18	9	4
Did not adopt	12	10	10	4	3	3	1	2
North Leigh, Alter 2								
Adopted	8	6	9	8	7	9	3	4
Did not adopt	9	4	1	3	1	2	-	-
North Leigh, Alter 3								
Adopted	1	6	4	6	2	7	3	1
Did not adopt	4	6	0	2	1	2	-	-
St Athan, Alter 1								
Adopted	4	3	9	6	4	6	6	3
Did not adopt	7	4	7	2	6	3	6	3
St Athan, Alter 2								
Adopted	0	5	3	7	2	3	3	2
Did not adopt	4	3	4	1	3	4	1	5
St Athan, Alter 3								
Adopted	3	2	3	6	2	2	3	1
Did not adopt	1	2	1	1	3	3	1	4
Alyth, Alter 1								
Adopted	18	17	18	6	30	20	21	9
Did not adopt	15	11	29	8	8	4	11	6
Alyth, Alter 2								
Adopted	14	12	10	2	18	9	12	8
Did not adopt	12	3	15	6	3	4	8	4
Alyth, Alter 3								
Adopted	13	4	5	2	12	6	12	5
Did not adopt	9	5	8	8	3	3	8	1

Hypothesis 5b

The raw frequency data of those who adopted and did not yet adopt (or adopted before the time of intervention) is presented in Appendix Table 45.

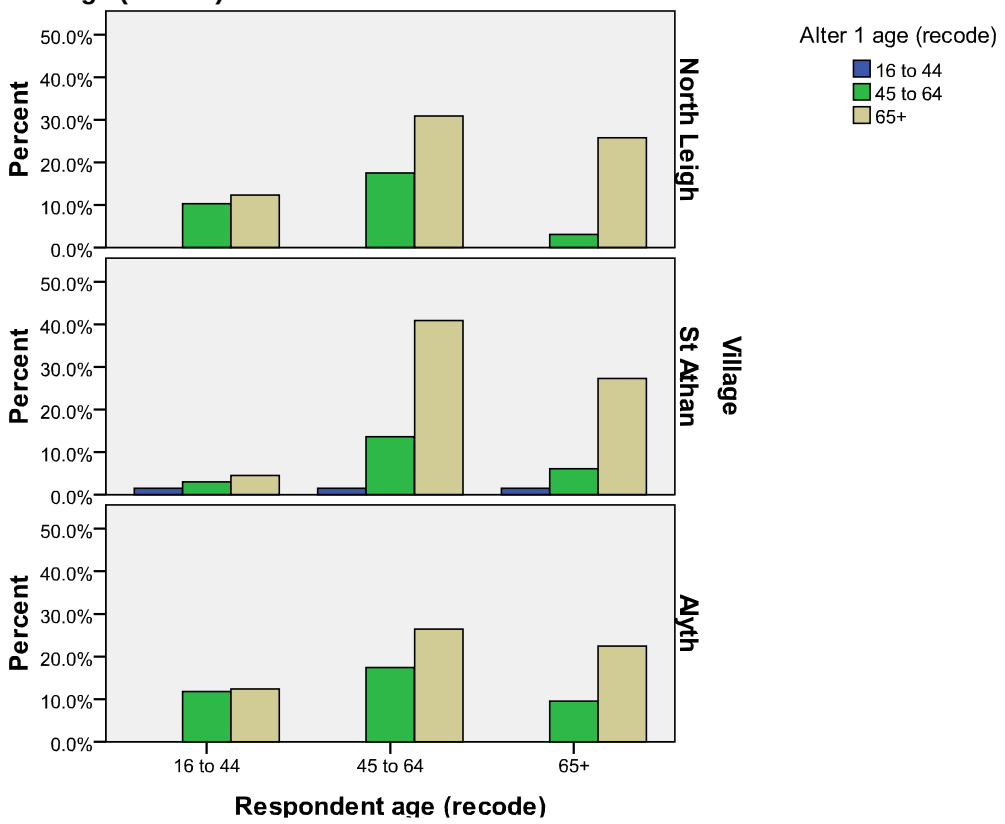
Appendix Table 45: Adopters and non-adopters of innovations & the strength of tie (strong or weak) of the alters with whom the respondents spoke to about those innovations (frequencies)

Community & Alter	WWDF		Visual		AHL		Behave	
	Strength of tie?		**Strength of tie?**		**Strength of tie?**		**Strength of tie?**	
	Strong	**Weak**	**Strong**	**Weak**	**Strong**	**Weak**	**Strong**	**Weak**
North Leigh, Alter 1								
Adopted	8	13	10	17	21	14	10	4
Did not adopt	11	12	9	8	4	2	4	0
North Leigh, Alter 2								
Adopted	6	8	8	6	10	5	6	1
Did not adopt	7	5	3	1	1	2	-	-
North Leigh, Alter 3								
Adopted	5	3	6	1	6	2	3	-
Did not adopt	7	2	1	1	3	0	-	-
St Athan, Alter 1								
Adopted	6	3	9	6	8	4	7	2
Did not adopt	7	3	8	2	6	3	6	2
St Athan, Alter 2								
Adopted	5	2	9	2	4	1	5	0
Did not adopt	4	4	4	1	5	2	5	1
St Athan, Alter 3								
Adopted	5	1	8	1	1	3	3	1
Did not adopt	3	1	2	0	5	0	3	1
Alyth, Alter 1								
Adopted	20	12	6	14	35	15	23	4
Did not adopt	15	9	16	19	7	6	12	4
Alyth, Alter 2								
Adopted	18	8	9	2	17	10	18	2
Did not adopt	12	3	14	7	6	1	8	4
Alyth, Alter 3								
Adopted	14	4	3	3	11	8	14	4
Did not adopt	8	6	9	7	6	0	6	3

Hypothesis 5c

A significant difference determined from the *p*-value in Chapter 8 does not appear to be associated with obvious difference in patterns between significant associations (North Leigh) and non-significant associations (St Athan and Alyth).

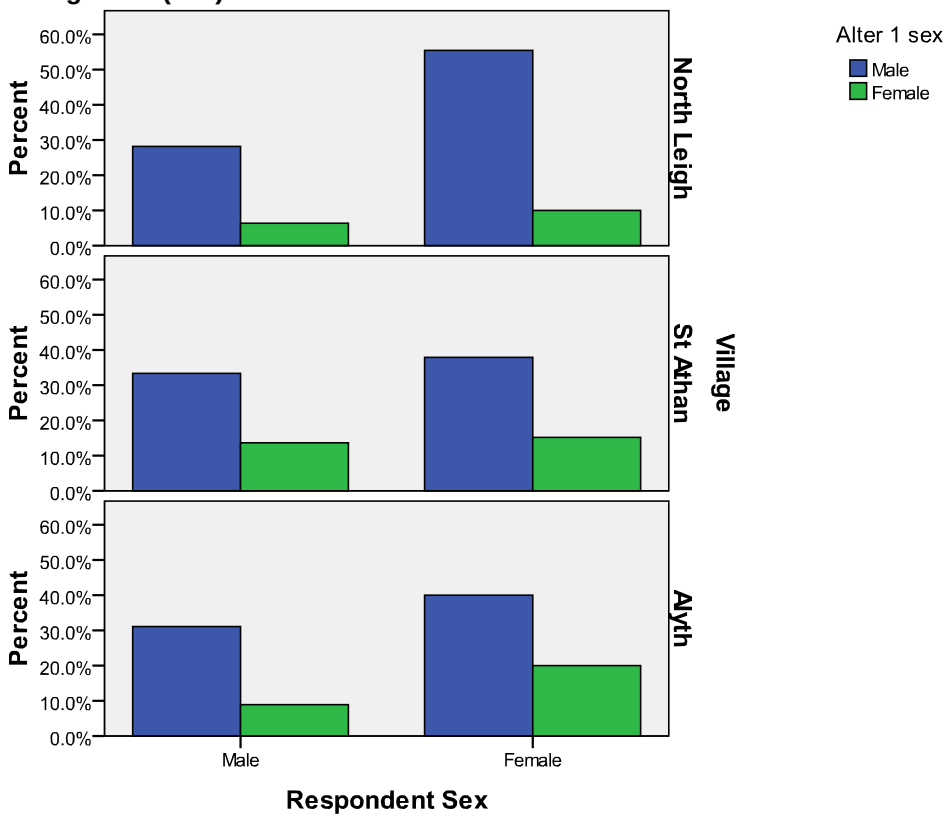
Appendix Figure 14: Comparison between respondent and Alter 1 on the homophily variable age (recode)



There appear to be a combination of effects in Appendix Figure 14. In North Leigh, those aged between 16 and 44 are more likely to contact those who are older, which is a sign of heterophily. A higher percentage of respondents in the age category 45 to 64 indicate contacting someone who is 65 years or over (i.e. heterophily), but there are still quite a few who contact people in their own age bracket (i.e. homophily). And for those 65 years or older, the majority contacted someone who was also 65 years or older (homophily). These patterns were fairly similar in St Athan and Alyth.

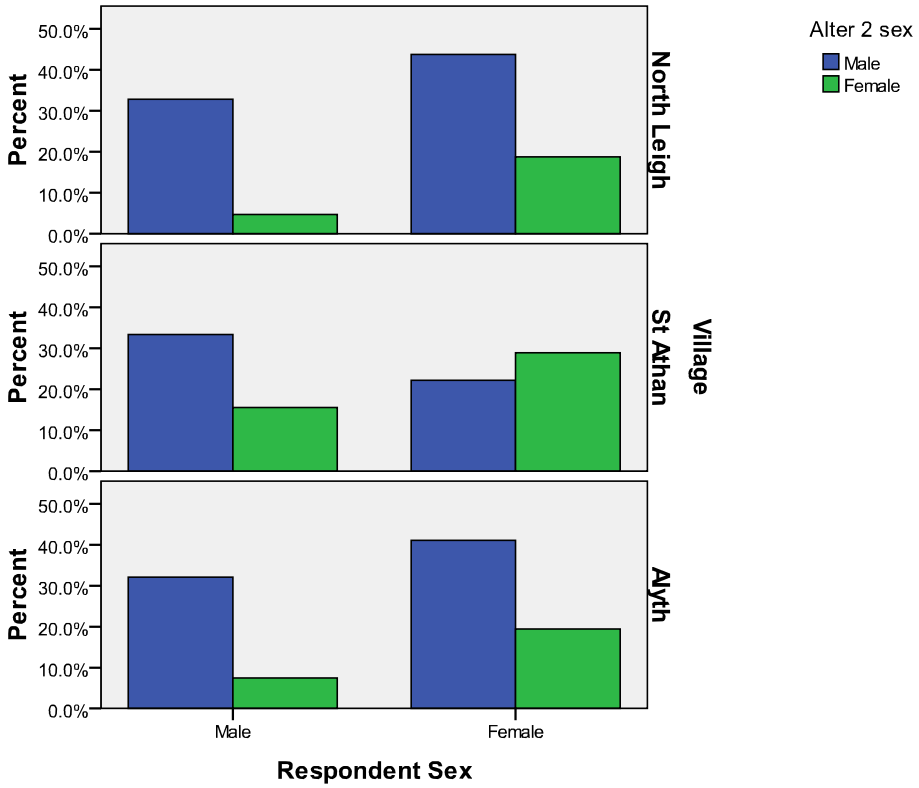
Though the chi-square significance tests did not show significant patterns of association to distinguish the two variables of gender (i.e. male or female) of the respondent and the alters, Appendix Figure 15 indicates that respondents, regardless of gender, were much more likely to contact men than women.

Appendix Figure 15: Comparison between respondent and Alter 1 on the homophily variable gender (sex)



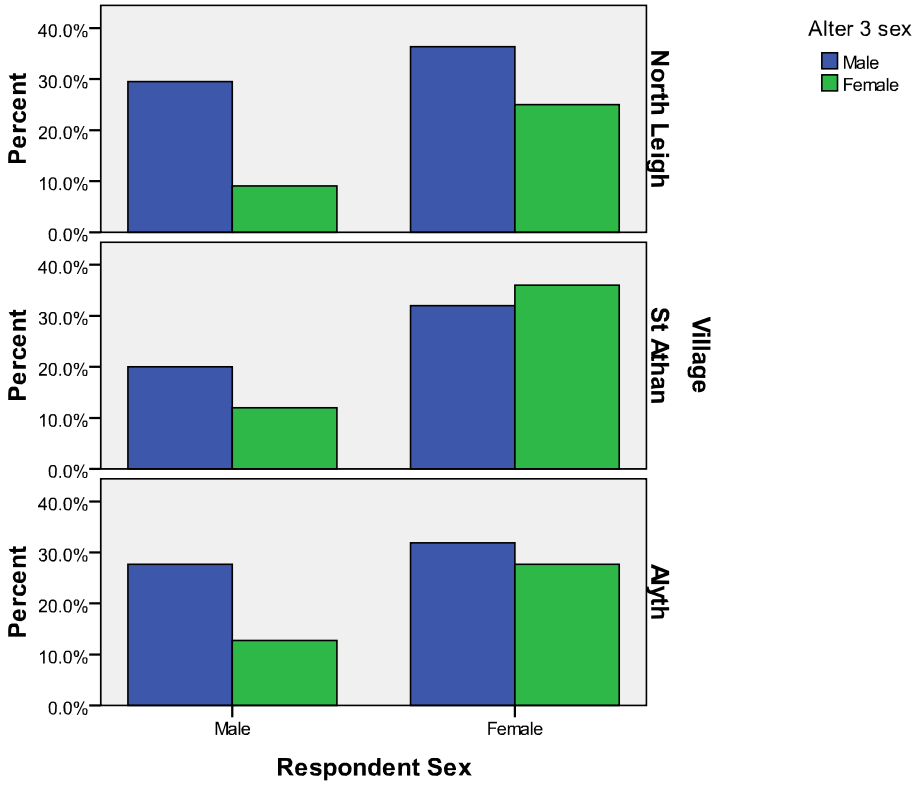
Results for Alter 2 (Appendix Figure 16) indicate a slightly higher percentage of female respondents in St Athan contacted females. For all others, male or female, they were still more likely to contact males.

Appendix Figure 16: Comparison between respondent and Alter 2 on the homophily variable gender (sex)



This was again the same for Alter 3 (Appendix Figure 17), though in North Leigh and Alyth, a higher percentage of both men and women were contacting other women.

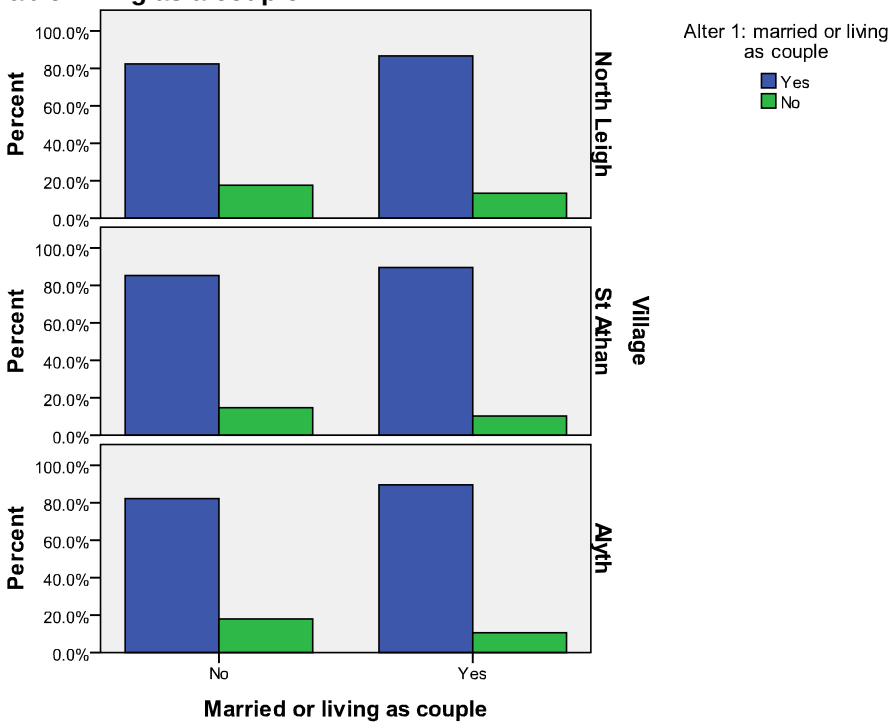
Appendix Figure 17: Comparison between respondent and Alter 3 on the homophily variable gender (sex)



These findings are particularly interesting, considering the order of listing the alters was completely arbitrary. Respondents were asked to name the three alters whom they spoke to the most, of those they had already mentioned earlier in the questionnaire. Respondents could list these people in any order. Therefore, it appears that there is a tendency for people to report men first. This cannot be interpreted as 'respondents are more likely to first approach men'. But it may reflect a cognitive tendency of recall, which could then be translated into actions. Further research would be needed, however, to understand if this is the case.

The third homophily variable – living with a partner – did not yield significant results in the chi-square and Fisher's exact tests. As Appendix Figure 18 demonstrates, whether or not respondent were married or living as a couple showed no difference in the choice of the alter approached; the majority of repondents approached alters who were reported as married or living as a couple. The results for Alter 2 and Alter 3 were very similar.

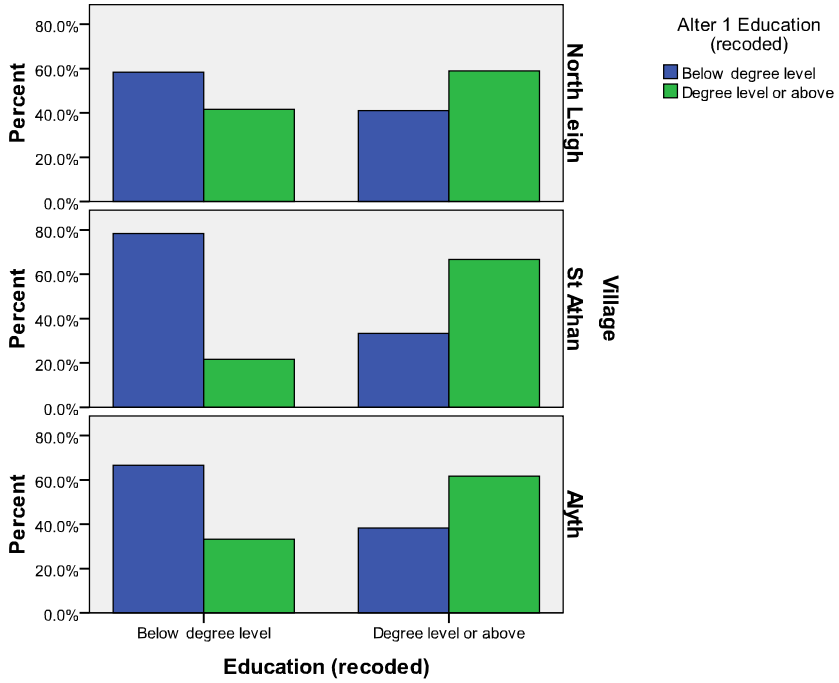
Appendix Figure 18: Comparison between respondent and Alter 1 on the homophily variable 'living as a couple'



The final homophily variable, education, demonstrated more instances of significant associations between the respondent and each of the three alters than any other homophily variable. In North Leigh, there was no significant association with the Alter 1, but there was with Alter 2 ($\chi^2(1) = 9.738$, $p<.01$) and Alter 3 ($\chi^2(1) = 3.882$, $p<.05$). In St

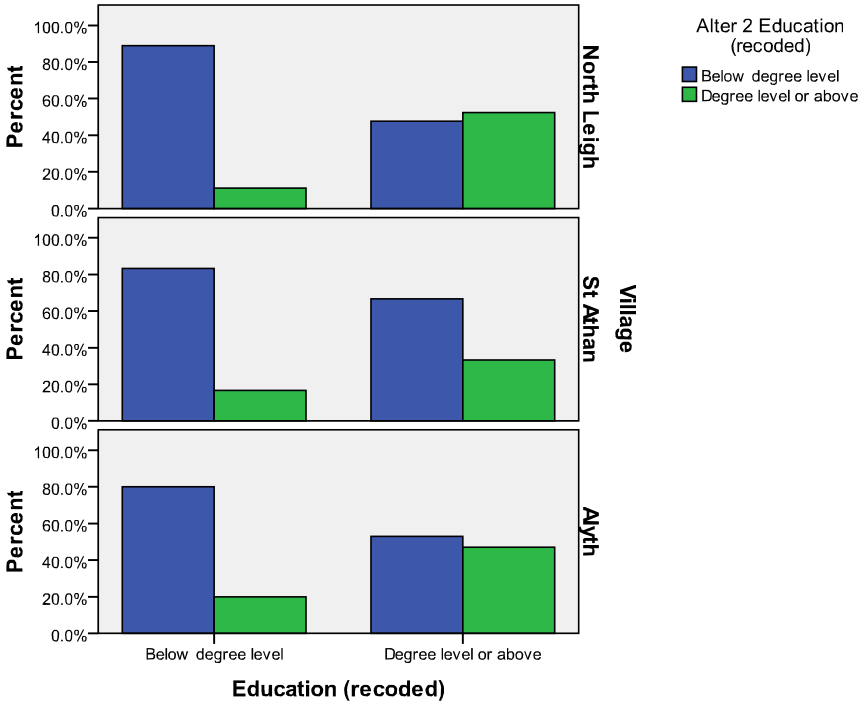
Athan, a Fisher's exact test indicated there was only a significant association between respondents and Alter 1 ($p<.05$). In Alyth, the results indicate a significant association between the respondents and Alter 1 ($\chi^2(1) =10.26$, $p\leq.001$) and Alter 2 ($\chi^2(1) =2.648$, $p<.01$), but not with Alter 3. To understand the data more fully, the data are presented in the next three graphs. Appendix Figure 19 compares the respondents' reported education level (recoded) and the educational level reported for Alter 1. The graph shows that those that had an education below degree level were more likely to contact others who had an education below degree level. Conversely, respondents who reported having above an education of degree level or above were more likely to contact others with a degree or above, across all three communities.

Appendix Figure 19: Comparison between respondent and Alter 1 on the homophily variable education (recoded)



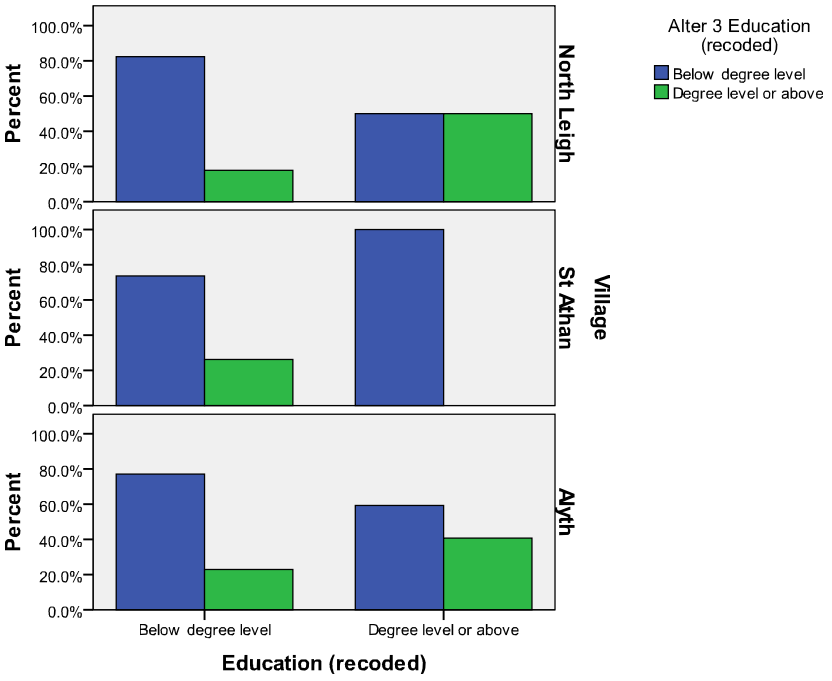
Appendix Figure 20 shows the same trends for those with reported education of below degree level, but for those who reported having a degree or above, they were more likely to contact someone with below a degree level in St Athan and Alyth, and in North Leigh respondents were just as likely to mobilise 'energy social capital' with either.

Appendix Figure 20: Comparison between respondent and Alter 2 on the homophily variable education (recoded)



Appendix Figure 21 demonstrates the results for Alter 3, which are fairly similar to Alter 2, except that respondents with a reported education of degree level or above in St Athan did not report contacting anyone, at all, who had a degree or above.

Appendix Figure 21: Comparison between respondent and Alter 2 on homophily variable education (recoded)



Chi-square tests yielded initial comparison information regarding the homophily between the respondent and the people with whom they mobilised ‘energy social

capital'. A further test was performed in order to address the hypothesis, i.e. the association between homophily and adoption of energy-reducing innovations. Chapter 8 contains the results of the Spearman's rho test comparing a homophily scale and an adoption scale. For descriptive purposes, Appendix Table 46 contains the frequencies of crosstabulation data between the adoption scale, ranging from zero adoptions to four adoptions, and the homophily scale, which ranges from no degree of homophily (i.e. the respondent and the alter do not have anything in common) to four instances of homophily, according to the variables gender, education, age, and whether or not the household contains a couple.

Appendix Table 46: Frequencies of data used in Spearman's rho tests of significance: homophily scale and adoption scale cross-tabulation

		Homophily scale				
		0 (Nothing in common)	1	2	3	4 (Similar in every category)
Alter 1						
	North Leigh					
	No adoptions	0	0	1	1	0
	Adopted in 1 innovation category	1	2	0	1	0
	Adopted in 2 innovation categories	1	7	7	6	0
	Adopted in 3 innovation categories	3	5	14	4	0
	Adopted in 4 innovation categories	2	2	0	2	1
	St Athan					
	No adoptions	-	0	2	0	-
	Adopted in 1 innovation category	-	1	2	2	-
	Adopted in 2 innovation categories	-	0	1	3	-
	Adopted in 3 innovation categories	-	4	2	1	-
	Adopted in 4 innovation categories	-	-	-	-	-
	Alyth					
	No adoptions	0	0	2	0	2
	Adopted in 1 innovation category	0	0	9	5	4
	Adopted in 2 innovation categories	5	4	6	7	4
	Adopted in 3 innovation categories	1	2	4	4	1
	Adopted in 4 innovation categories	0	0	1	7	1
Alter 2						
	North Leigh					
	No adoptions	0	0	1	0	0
	Adopted in 1 innovation category	1	1	0	1	0
	Adopted in 2 innovation categories	1	3	4	6	0
	Adopted in 3 innovation categories	0	2	6	8	0
	Adopted in 4 innovation categories	1	0	1	1	1
	St Athan					
	No adoptions	-	1	1	0	0
	Adopted in 1 innovation category	-	0	4	1	0
	Adopted in 2 innovation categories	-	0	1	2	0
	Adopted in 3 innovation categories	-	1	3	1	1
	Adopted in 4 innovation categories	-	-	-	-	-
	Alyth					
	No adoptions	1	0	0	1	1
	Adopted in 1 innovation category	1	0	3	6	1
	Adopted in 2 innovation categories	0	6	5	8	1
	Adopted in 3 innovation categories	0	2	3	5	0
	Adopted in 4 innovation categories	0	0	6	1	1
Alter 3						
	North Leigh					
	No adoptions	-	-	-	-	-
	Adopted in 1 innovation category	0	0	0	2	0
	Adopted in 2 innovation categories	0	1	3	7	0
	Adopted in 3 innovation categories	1	5	3	3	1
	Adopted in 4 innovation categories	0	1	1	0	0
	St Athan					
	No adoptions	0	1	0	0	-
	Adopted in 1 innovation category	0	1	1	1	-
	Adopted in 2 innovation categories	1	0	0	0	-
	Adopted in 3 innovation categories	0	1	2	2	-
	Adopted in 4 innovation categories	-	-	-	-	-
	Alyth					
	No adoptions	0	0	2	1	0
	Adopted in 1 innovation category	0	1	4	1	1
	Adopted in 2 innovation categories	1	1	5	8	0
	Adopted in 3 innovation categories	0	2	2	2	1
	Adopted in 4 innovation categories	0	0	2	4	1